



HEALTH INFORMATION SYSTEM (HIS) ASSESSMENT REPORT

PALESTINIAN HEALTH CAPACITY PROJECT

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ACRONYMS

ADSL	Asymmetric Digital Subscriber Line
API	Application Programming Interface
Avicenna HIS	DataSel Health Information System
BI	Business Intelligence
CMC	Computer Media Center (HP & Cisco Partner in Ramallah)
DG	Director General
EHR	Electronic Health Record
EMR	Electronic Medical Record
GCC	Government Computer Center
HQ	Headquarter
HR	Human Resources
ID	Identification
ISO	International Standards Organization
IT	Information Technology
Jira	Ticketing System for Avicenna issues
MB	Megabyte
MEASURE	USAID MEASURE Evaluation Phase IV
MOF	Ministry of Finance
NGO	Non Governmental Organization
OJT	On the Job Training
PACS	Picture Archiving and communication System
PMOH	Palestine Ministry of Health
PC	Personal Computer
PHC	Primary Health Care
PHCP	Palestinian Health Capacity Project
PHIC	Palestinian Health Information Center
PMC	Palestinian Medical Complex
PNPHI	Palestinian National Public Health Institute
QA	Quality Assurance
RH	Reproductive Health
SDK	Software Development Kit
SPD	Service Procurement Department (Referrals)
SOW	Scope of Work
STTA	Short-Term Technical Assistance
TA	Technical Assistant
TIA	Telecommunication Industry Association
TWG	Technical Working Group
UHC	Universal Health Coverage
USAID	United States Agency for International Development
WBG	West Bank and Gaza
WHO	World Health Organization

EXECUTIVE SUMMARY

This report presents findings and recommendations from an assessment of the Avicenna Health Information System (HIS) in use in select Palestinian Ministry of Health (PMOH) health facilities. The assessment was conducted by the USAID-funded Palestinian Health Capacity Project (PHCP) led by IntraHealth International. The PHCP's goal is to improve the quality and coverage of health care at all levels in West Bank Gaza (WBG). One of the project's objectives is to strengthen the PMOH's ability to collect, organize, maintain and use electronic data to support the provision of efficient, effective, high-quality health services. This assessment was undertaken to determine the current status of Avicenna HIS in PMOH and present recommendations that could be implemented to improve the ability of PMOH to use this system to support data driven decision making.

Assessment activities took place in the West Bank from July 12, 2015 – August 24, 2015. During that time, an assessment team comprised of 3 PHCP information consultants plus the PHCP Referral Technical Specialist visited 13 hospitals (10 PMOH and 3 NGO). Twelve facilities had Avicenna HIS implemented and three were awaiting implementation. The team also visited the Data Center in Ramallah/PMC, the backup Data Center in Nablus, and the PMOH's main warehouse facility. They also convened meetings with key Avicenna HIS stakeholders (see appendix K Stakeholder) including the PMOH IT, PMOH Director General (DG) of Hospitals, WHO/Palestine Institute of Public Health, World Bank, DataSel, Dimensions, CMC and Ultimatat to ascertain system usage and perform a needs assessment.

Target audience

The primary audience for this report includes USAID and the Palestinian Ministry of Health and may also have implications for others responsible for developing national and sub national healthcare information system systems and policies. The information in this report will be useful for developing next steps in Avicenna HIS and national level health information systems ecosystem work.

Background

Between 2008 and 2014, the PMOH partnered with the USAID-funded Palestinian Health Sector Reform and Development Project (the "Flagship" Project) to implement a computerized Health Information System (Avicenna HIS) in selected facilities (hospitals, clinics and PMOH offices) in the West Bank. Avicenna HIS system is an extended electronic health record (EHR) system and includes functionality for medical charts; registration, scheduling, and financial information of patients; laboratory results; prescription information, including ordering, dispensing and tracking medications; systems for maintaining, aggregating and reporting data. Avicenna HIS is propriety software of DataSel. Implementation of the system was primarily supported by Dimensions, a local IT company.

The PMOH has a strategy to implement the Avicenna HIS in all its hospitals as the foundation for a national-scale, longitudinal electronic health records for all citizens. Currently, the Avicenna HIS is implemented in 18 PMOH facilities (8 PMOH hospitals, 8 primary health care clinics, the national blood bank) and in PMOH administrative offices. In addition, under the PMOH national license and supported by USAID funding, the Avicenna HIS is being installed in two Palestinian NGO Hospitals -- Al-Makassed and Caritas Baby Hospital. Another NGO hospital, St. John's Eye Hospital, also received funding from USAID for HIS support and is negotiating a contract with a local company (Dimensions) to implement their new product (Apex HIS based on the Avicenna system) system in 2015.

The Avicenna HIS resides within the PMOH IT unit, led by Mr. Ali Helou, Director General of Engineering and Information Technology (IT). The unit includes 31 IT staff supporting HIS activities in facilities and at the central level. This unit has proposed reorganizing its structure and increasing its workforce (see Appendix I).

To date, the PMOH has not directly funded any Avicenna HIS activities except paying for the connectivity and Avicenna HIS consumables. The Data Center is currently maintained by a former Flagship subcontractor, Dimensions. System maintenance costs were forward funded until September 30, 2015 even though the Flagship project ended September 2014.

Summary of Findings

The overarching primary finding is that the Avicenna HIS is in active use at *all* PMOH facilities where it has been installed. Hospital administrators universally regard Avicenna HIS to be crucial to the facility's operations. Moreover, every one of the four assessed facilities that does not yet have the Avicenna HIS, would like it installed as soon as possible.

Successes

A summary of the assessment's generally positive findings follows:

1. The Avicenna HIS is in active, continuous use in every hospital where it is has been deployed. It is heavily relied upon for basic patient management in the units/departments and for hospital administrative decision-making. Facilities utilize Avicenna HIS extensively for administrative reporting. The NGO hospital also uses the financial modules for costing and other financial reporting although PMOH hospitals make less use of the financial modules.
2. PMOH DG of Hospitals, Dr. Mohammed Abu Ghali, has considerable enthusiasm for the system and uses HIS data to inform resource allocation decisions across hospitals.
3. Facilities using Avicenna HIS cite improved tracking in the number of patients seen; they are aware of which patients have been seen each day and appreciate the instantaneous sharing of information between hospital units and hospitals.
4. Strong and well-skilled champions exist within the PMOH IT group.

5. The Avicenna HIS has high visibility across the WB. Facilities without it are requesting to be put on the 'wait list' for implementation. Many have been visiting HIS-enabled facilities in preparation for their own implementations.
6. Leveraging the centralized HIS implementation at the PMOH Data Center, a national-scale, unique patient ID has been started.

Gaps

Even with acknowledgement of these achievements, numerous gaps and common issues were consistently articulated by facility and central staff. Gaps and issues identified during the assessment include:

1. **Lack of PMOH Ownership.** Not all the Ministry of Health top management appear to be supportive of the HIS according to several key stakeholders interviewed including the PMOH IT unit and as evidenced by the lack of funding that PMOH has provided for HIS. Without his explicit support for financing the system, it is likely impossible for the PMOH to step up as the clear and unambiguous "owner" of the Avicenna HIS (including funding the ongoing maintenance, support and operation of the system.)
2. **Absence of digital health framework.** It is important for PMOH to establish and lead the governance of Palestine's overall digital health strategy and to enact the appropriate policies and legislation needed to support it.
3. **Insufficient data quality.** Clinical data quality in the HIS (e.g. coded diagnoses, procedures, orders, etc.) is generally regarded as poor. Although administrative benefits are being realized from the HIS, without improved data quality it will be impossible to realize important care quality and clinical efficiency benefits. Poor data quality impedes the ability to leverage the Avicenna HIS to improve referral workflows.
4. **Inadequate technical support and absence of a Help Desk.** Many of those interviewed complained of poor responsiveness to technical support requests. There is a backlog of technical support tickets (JIRA tickets) and communication between the support organization (Dimensions/DataSel) and the facility users has been very poor. Dimensions identified a number of support tickets as frivolous, others were categorized as "feature requests" (not bugs) that would require additional funding before being addressed, and many issues were identified as ones that DataSel needed to resolve.
5. **Inability to customize reports and user interfaces.** Stakeholders noted that the Avicenna HIS does not allow them the ability to customize user screens or generate customized reports. As evidence, many JIRA tickets relate to customizations to Avicenna's data entry forms and reports.
6. **Challenges in information exchange and integrating the Avicenna HIS with 3rd party applications and with medical devices.** The current system does not allow for establishing interoperability with other information systems. A number of the open system issues (JIRA tickets) pertain to challenges in connecting 3rd party applications and external devices to the HIS Avicenna software.
7. **Implementation costs and sustainability.** The HIS implementation costs incurred by Flagship project and how these relate to actual procurement and service provision is

not always clear. Staff at the facility level (mainly the directors) expressed repeated concerns regarding Avicenna HIS sustainability in terms of who will pay for and support system upgrades and maintenance and provide replacement equipment and training.

Recommendations

Overcoming the gaps and issues identified by the present assessment should be regarded as an opportunity to liberate even greater value out of the investments that have already been made.

Recommendations would best be implemented in a three phased approach. Appendix K provides a detailed description of recommendations by phase. The following recommendations for immediate attention (Phase 1) arise from the assessment's findings:

1. A meeting that includes the USAID and/or PHCP should be convened with the Minister of Health to update the Minister regarding the assessment's findings and to garner Avicenna HIS overt support for the Avicenna HIS and the foundational role PMOH can play in supporting an overall Palestinian digital health strategy.
2. The PMOH IT Director should be advised and supported to develop the necessary budgets, needed training and transition plans to support Avicenna HIS. The PMOH IT Director could be provided with a secondment to this group to act as a capacity building manager (second in command).
3. The PMOH will require assistance in establishing and managing the governance needed to develop a national digital health strategy. This digital health strategy would include legal, regulatory and policy guidelines and procedures. A technical working group could be established to bring high level support for developing this strategy.
4. A strengthened technical support capacity is required for PMOH IT to take on the functions that were provided by Dimensions. The PMOH IT Director should be assisted in establishing an active knowledge management strategy and a toolset to do this. Additionally, the PMOH IT group's knowledge management and communications capabilities should be supported to promote the Avicenna HIS's implementation's successes that have in the past been under-reported. There is an opportunity to develop a vibrant community-of-practice regarding this important "cornerstone" in a Palestinian digital health strategy.
5. Avicenna HIS maintenance, Super Admin rights, system licenses and Data Center operation should be immediately transitioned from Dimensions to the PMOH IT team. As a practical matter, to ensure continuity, it is recommended that Dimensions' contract, expiring September 30, 2015, be renewed as a transitional contract by quarter until such time as the transition to the PMOH is complete.
6. In order to address the significant number of pressing issues related to Avicenna integration and customization, the PMOH IT Director should be assisted by technical experts in specifying a work plan and negotiating a contract with DataSel to complete the needed Avicenna software functionality modifications, this could include financial support.

7. Assistance should be provided to the PMOH to develop training programs and quality assurance tools (e.g. custom reports) that will support a data quality improvement initiative. Execution and operationalization of this initiative should be led by the PMOH QA team.
8. The PMOH IT Director should be assisted to coordinate interoperability with related programs (e.g. SPD's web-based referral application and referral management system, MENA HR,WHO RH initiative (DHIS 2), World Bank UHC initiative, UNRWA, etc.). The scope of this effort should include both technical cooperation and donor funding cooperation/pooling and utilize an open architecture approach such as OpenHIE.

The following activities are recommended to strengthen Avicenna HIS and ensure its sustainability that could be carried out in Phases 2 and 3:

1. Strengthen the Avicenna HIS in existing facilities, sign maintenance contracts, apply new fixes and customizations, and refresh the hardware in use.
2. Leveraging the assistance of the seconded manager, the PMOH IT Director should assemble a project team and contribute to the implementation of the Avicenna HIS at the 4 remaining PMOH hospitals with reasonable support from DataSel and/or another subcontractor. The scheduling of these implementations will depend upon the timing of work required for Avicenna integration and customization fixes. The new Avicenna HIS rollouts should include the fixes and software enhancements needed in the Avicenna product before implementation in other facilities. Consideration should also be given to rolling out different hardware technology (e.g. thin-client computers/N-computing, client-server) as a lower-cost and more sustainable hardware architecture option.
3. Continue to enhance the system to support Information exchange and interoperability with related programs (e.g. MENAHR, WHO RH initiative (DHIS 2), World Bank UHC initiative, UNRWA) through development of application program interfaces.
4. Assess capacity of Avicenna HIS to support disease surveillance and reporting.

Risks

This assessment has identified that the most glaring risk is the risk of inaction coupled with the need for ownership of the Avicenna HIS within the PMOH. Professional project management and risk mitigation techniques are available to address the risks associated with all of the recommended activities. To not proceed with the proposed recommendations, however, puts at risk the benefits that have already been realized by the Avicenna HIS implementation. Specifically, the present lack of "ownership" of the system by the Minister and by the PMOH (organizationally) must be addressed. Without PMOH ownership, it is unlikely any other aspect of the recommended plan of action could succeed. Equally – without the rest of the plan of action, it is unlikely the PMOH will be able to successfully take ownership.

Health information exchange and interoperability between systems are critical for a strong health information ecosystem. Risks in not addressing this component means that various systems will exist in silos, information will be duplicated, and information not exchanged.

Avicenna HIS is not an open source software, which limits the PMOH procuring the customizations from any other vendor. As a result, it may not be in a strong negotiating position when required to procure services from DataSel.

Conclusion

Now is not the time to lose the gains of the last 6 years but rather to address the gaps, leverage champions, actively engage the Minister of Health and each Hospital Director to support, utilize, and extend the Avicenna HIS for the benefit of improved health services for Palestinians.

INTRODUCTION

This report presents findings and recommendations from an assessment of the Avicenna Health Information System (HIS) in use in select Palestinian Ministry of Health (PMOH) health facilities. The assessment was conducted by the USAID-funded Palestinian Health Capacity Project (PHCP) led by IntraHealth International. The PHCP's goal is to improve the quality and coverage of health care at all levels in West Bank Gaza (WBG). One of the project's objectives is to strengthen the PMOH's ability to collect, organize, maintain and use electronic data to support the provision of efficient, effective, high-quality health services. This assessment was undertaken to determine the current status of Avicenna HIS in PMOH and present recommendations that could be implemented to improve the ability of PMOH to use this system to support data driven decision making.

The following report is organized into four sections:

1. Approach
2. Findings
3. Recommendations
4. Conclusion: What does success look like?

The rest of this section describes the process that was followed by PHCP to conduct this assessment and the stakeholders involved.

Assessment Process

Starting July 12 until August 21, PHCP conducted a needs assessment of the Avicenna Health Information System (HIS) in support of strengthening the capacity of the PMOH to collect, organize, maintain and use electronic data to support the provision of quality health services at all levels in the WBG. This assessment is intended to inform the PHCP's strategy for supporting HIS and contribute to project work plan and budgeting processes.

Assessment activities took place in the West Bank with a team comprised of 3 PHCP information technology consultants plus the PHCP Technical Referral Specialist. The informatics consultants included Abdulhamid Qusrawi, a local Avicenna HIS consultant and former Flagship Avicenna HIS lead, Donna Medeiros an international consultant and part of IntraHealth's informatics team, and Derek Ritz, an international consultant who had conducted a previous assessment of referral processes and systems for PHCP. This assessment team reviewed background information, conducted site visits and stakeholder interviews and analyzed information to formulate the recommendations contained in this report.

Scope of HIS Assessment

The needs assessment addressed the following areas:

- Existence of national policies and capacity building at the PMOH; (such as E-Health/digital health strategy, ICT policies) and change management procedures;
- Planning for Avicenna HIS sustainability especially at facility level;
- Hardware and software needs and planning for routine maintenance, ongoing support, and ownership;
- Plan for retraining staff (OJT, E-learning);
- Existence of facility, regional and national level PMOH Avicenna HIS champions;
- Costing factors, budgets and plans in place. For instance, inclusion of Avicenna HIS / EHR requirements as part of the routine budgeting process including hardware refreshes;
- Capacity in data management and usage;
- Existence of procedures and processes to ensure the quality of data;
- Means and measures to assess data quality;
- Integration status of medical equipment, especially laboratory devices
- Avicenna system integration with various different solutions within the HIS ecosystem;
- Ongoing monitoring and evaluation of facility data via reports, establishment of national data warehouse.

Facilities and sites visited

To review the Avicenna HIS in operation and assess current status and needs, the team visited 13 hospitals (10 PMOH and 3 NGO), the Data Center in Ramallah/PMC, the backup Data Center in Nablus, and the PMOH's main warehouse facility. During each hospital visit, the team met with the Hospital Director, administrative lead, head clinicians, the head nurse, and PMOH IT staff. Appendix B lists the hospitals and facilities visited.

Stakeholder interviews

Since Flagship inception, numerous stakeholders have been involved in the Avicenna HIS. A main component of the assessment was to understand stakeholder roles and relationships and identify key issues and gaps in oversight, development, implementation, maintenance and support. Specific Avicenna HIS stakeholders with roles and responsibilities in developing, implementing, and maintaining the system are listed in Appendix J Stakeholders table. Meetings were also convened with key Avicenna HIS stakeholders including the PMOH IT, PMOH DG of Hospitals, WHO/Palestine Institute of Public Health, World Bank, DataSel, Dimensions, CMC and Ultimitat to ascertain system usage and perform a needs assessment. In all, the assessment team met with 75 individuals.

Document review

Additionally, the accumulation and review of Avicenna HIS Flagship documents and information proved vital to performing the assessment. While many of the requested documents were provided by the PMOH, some remained pending at the time of this report. In particular, Dimensions cited disclosure issues requiring USAID/Chemonics/PMOH consent which the assessment team tried unsuccessfully to resolve. Outstanding information includes Avicenna HIS

design diagrams for facilities, assessment reports, and the Data Center and Disaster Recovery technical specifications.

OVERVIEW OF AVICENNA HIS AND FINDINGS ON CURRENT STATUS

This section describes the status of Avicenna HIS in the facilities status of Avicenna HIS implementation, and suggestions for new (proposed) facilities. Finally this section presents major challenges, gaps and opportunities.

Scale of Avicenna HIS Implementation in PMOH

This subsection provides background details of the Flagship Avicenna HIS facility implementation including objectives of the Flagship project, where the system was implemented, the Avicenna software, major costs incurred to implement Avicenna HIS, licensing and support.

Between 2008 to 2014, the USAID funded Palestinian Health Sector Reform and Development Project (Flagship) partnered with the PMOH to implement an electronic Health Information System - Avicenna HIS Avicenna - in a total of 18 PMOH facilities in Palestine (8 PMOH hospitals, 8 large primary health care clinics, the national blood bank and PMOH offices).

Specifically, Flagship set forth the following objectives that Avicenna HIS was to address:

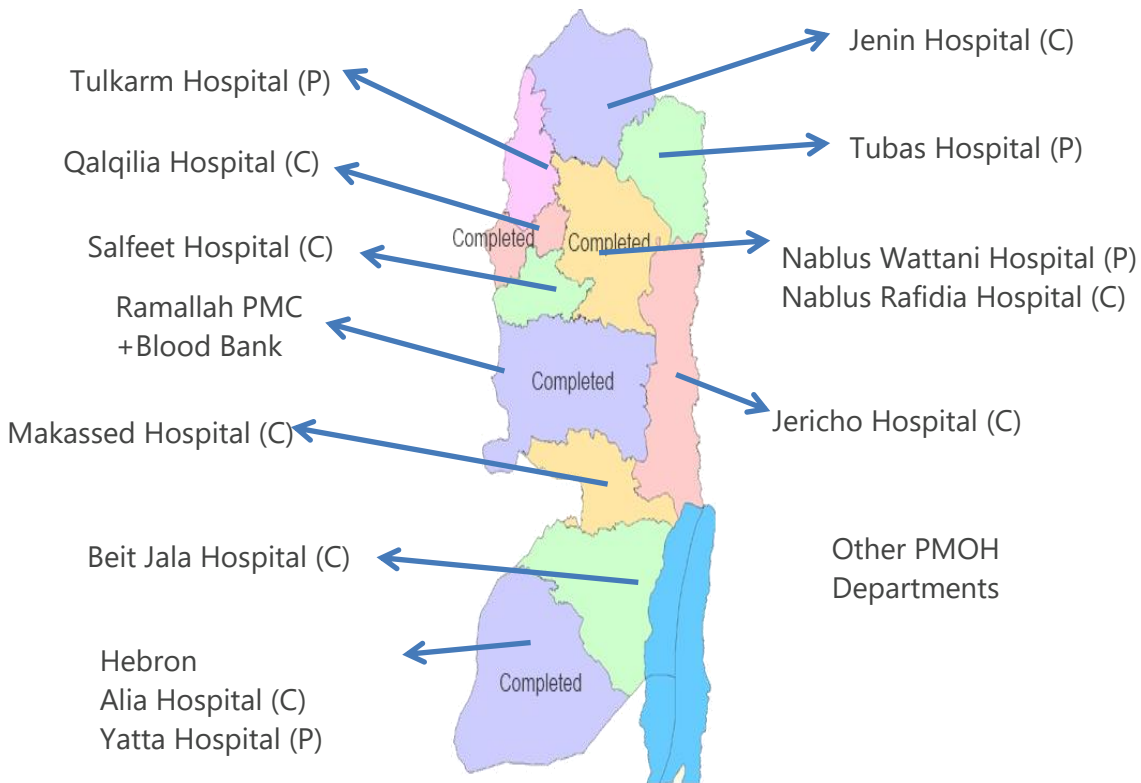
- Integrate healthcare record systems.
- Improve governance, planning, administration and management of health systems.
- Improve the efficiency of health service delivery.
- Develop a population health care database.
- Facilitate monitoring and evaluation of health trends.
- Provide data for decision making.
- Provide a tool that will underpin the Ministry's reform agenda

The first hospital to implement Avicenna HIS was Rafidia Hospital in 2010. Implementation of the Avicenna HIS at the facility level was performed by a local Ramallah based company, Dimensions, which utilized a subcontractor, Ultimitat, to perform the assessments and implementation. Implementation in Rafidia Hospital required 9 months as it was the first hospitals to implement the Avicenna HIS. Other large hospitals like Alia and the PMC required a 3 month implementation period while smaller hospitals like Jericho and Salfit took one to two months for implementation.

The most recent (2014) Avicenna HIS implementation was in the non-governmental hospital Al Makassed in east Jerusalem. Figure 1 depicts the status of Avicenna HIS implementation under Flagship.

Figure 1. Status of Avicenna HIS Implementation in PMOH Hospitals

C = Completed, P = Planned



Overview of Avicenna HIS Software Functions and Architecture

The Avicenna HIS software chosen as the Palestine electronic patient management and monitoring system is developed and maintained by DataSel, a software company located in Ankara, Turkey. The system includes financial, medical, administrative functions and a centralized database option with an Oracle backend.

The main Avicenna modules included, though not necessarily utilized, in the PMOH Avicenna HIS version include:

- Security and Access Control System
- Billing and Accounts Receivable System
- Outpatient (Polyclinic) Information System
- Inpatient (Clinic) Information System
- Radiology Information System
- Laboratory Information System
- Pharmacy Information System

- Order and Request Management System
- Medical Records System
- Blood Bank Information System
- General Appointment System
- Emergency Room Module
- Maintenance Management System
- Dietary Service Management System

Pathology Information System
 Operating Room System
 Hemodialysis Information System
 Budget Management System*
 Financial Management System*

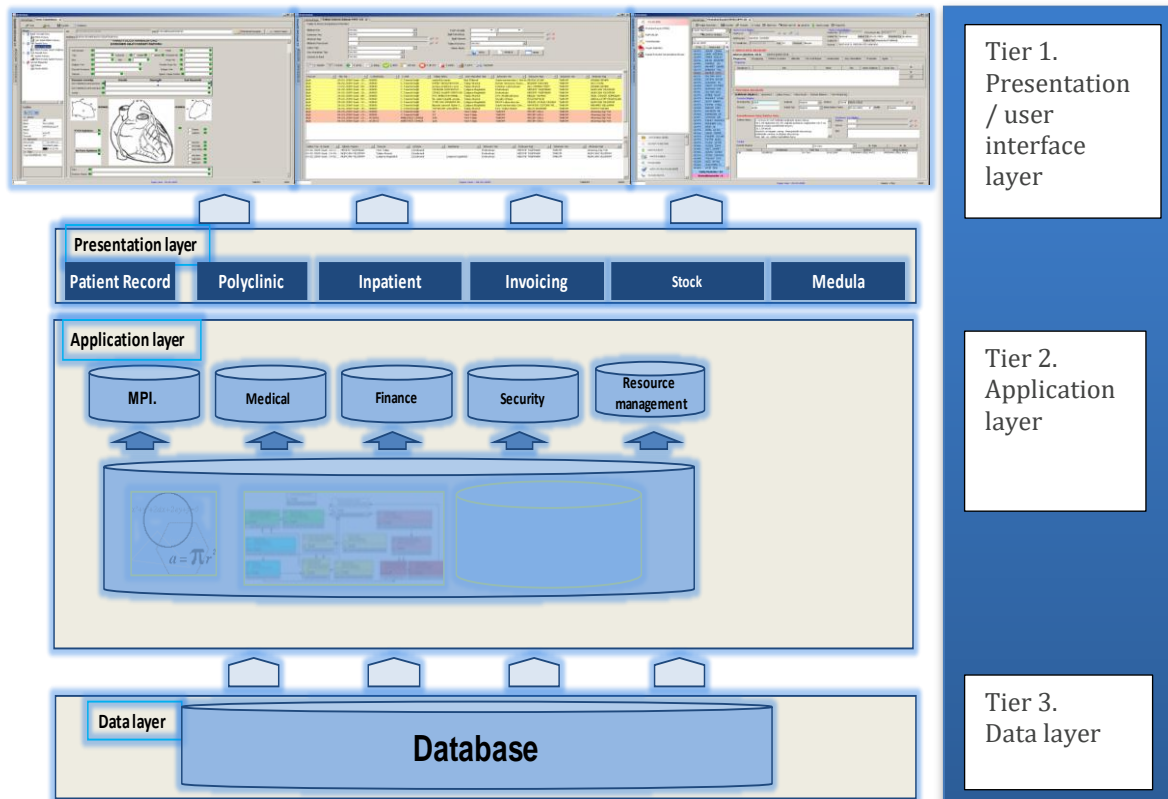
Material Management System (Inventory)
 Laundry Services Management System
 General Ledger*
 Fixed Assets Management System*
 Transportation Services Management System

*not used by PMOH hospitals but used by NGO hospitals

Avicenna does not specifically include a module to support the referral process (an issue of particular interest to PHCP) but has certain features that are used to process a referral application at the hospital level. PMOH doctors that want to initiate a referral can look at the patient medical history and put notes on the referral case. This same information could be transferred to the regional referral committees for review but this is not happening presently. Linkage of Avicenna HIS to the Service Purchase Department (SPD) also does not exist at present. The Avicenna HIS system would need to become more open and allow utilization of Application Programming Interfaces (APIs) for linkage to SPD current web base application and referral management system.

The Avicenna HIS system architecture is illustrated in Figure 2, below. Figure 2 shows an integrated clinical system based on a 3-tier design with a presentation (interface) layer, application layer, and data layer. For the WBG implementation of the Avicenna software the data layer is comprised of a centralized Oracle database hosted at the Data Center at the PMC.

Figure 2: Avicenna HIS system architecture



Licensing and Support

In 2013, the Flagship project acquired an unlimited Avicenna HIS 'open' license for the PMOH to install and use the version of the system across the West Bank PMOH and NGOs facilities and discounted license price for the private sector and Gaza facilities at a cost of \$2.0 million. The system relies on an Oracle database located at a central Data Center which requires annual licensing at approximately \$50,000. USAID paid for this through Flagship but since the project ended the Data Center is operating without an Oracle license.

All data from PMOH facilities using Avicenna HIS is stored in the Data Center in Ramallah located at the Palestinian Medical Complex (PMC). Facility to Data Center access is via fiber optic direct line that was provided by Paltel through an agreement with the Ministry of Telecommunications.

With the conclusion of the Flagship project on October 23, 2014, the project-level support for Avicenna HIS ceased. Dimensions and DataSel continued a level of maintenance and support for existing facilities forward funded by the Flagship project. In this past year, facilities and stakeholders have relied on Dimensions and the PMOH IT staff to provide support to the hospitals ending September 30, 2015. Via a separate USAID funding mechanism, Dimensions is currently implementing Avicenna HIS in select hospitals including Caritas, where Avicenna HIS is still under the users acceptance testing phase.

Status of implementation

PMOH facility implementation. Appendix B provides the Avicenna HIS status and findings specific to each facility assessed (12 facilities assessed).

Data center. While significant resources have gone into building and maintaining a strong Data Center that serves as the repository for all Avicenna HIS facility data, this data center is not maintained to ISO and TIA standards. It has a higher average down time (99.37%) than considered acceptable in the industry (99.7%). Temperature controls have been tripped several times without quick intervention to fix the issue. The Database server has two levels of redundancy within the Data Center. In case of failure on the main server a secondary server takes over automatically. However, the staff who operate the Data Center do not routinely test to ensure this redundancy is functional.

Disaster Recovery center. This is located in Nablus. Some confusion appears to have existed between the PMOH and Dimensions on the purpose and functionality of this site. The site is a backup site for the data center in PMC. Automatic cut over to the disaster recovery center does not happen if the main Data Center is down. It is only manually cut over by design as stated by Dimensions. Currently Dimensions staff will manually cut over to the disaster recovery center when the main Data Center is down for at least 2 hours. The disaster recovery center keeps an up-to-date copy of all data residing at the main Data Center in the PMC. There is a disaster recovery plan in place but it is not routinely updated.

Avicenna HIS Implementation Costs

Costing was not under the scope of this assessment and will require serious negotiations with vendors once a decision is reached to upgrade the current system and implement the Avicenna HIS in other facilities. Appendix C outlines major Flagship Avicenna HIS costs incurred. The cost of Avicenna HIS implementation per facility was based on 'per bed' costing model (\$2841/bed) with the equipment priced separately. Appendix F is an example of a facility level implementation cost estimate for Avicenna HIS provided by Dimensions for a new facility (Tulkarem). Going forward it is anticipated that the costs for Avicenna HIS implementation might be less as implementation is easier now that Avicenna HIS is known throughout the PMOH.

The Avicenna HIS software source code is not accessible under the PMOH open license agreement. This means that any required changes (e.g. adding fields to a screen, adding a new workflow or functionality designing application programming interfaces) to the Avicenna HIS will require work from DataSel. As this is not an open source software, any modifications to the HIS will require payment to DataSel to perform the needed customizations. Once the application programming interfaces (APIs) are in place this will solve the issue of integrating the Avicenna HIS with other systems/devices. The Avicenna source code is held in escrow to safeguard against a situation where DataSel no longer continues as an active business.

Status of Avicenna HIS in Health Facilities

This subsection covers how the system is used by the PMOH, common findings and unmet needs/opportunities.

Avicenna HIS is in use in all hospital departments, starting at the patient's entry point (registration) to the inpatient wards, outpatient clinics through patient discharge and accounting/billing. It is also in use in support services departments including the pharmacy, laboratory, radiology and pathology. Administrative departments also use the system as does maintenance (bio-medical engineering and general maintenance), the hospital's warehouse, kitchen and morgue.

In the primary health care clinics, Avicenna HIS seems to be less utilized in some clinics that continue to rely on paper-based processes. This is true especially in the specialized clinics and other health departments like the mental health clinic, the mother and childcare department, vaccination, infectious disease monitoring, and the environmental health departments. These units require Avicenna HIS modification and/or customization so that the system can better meet the needs of these departments.

Successes

The assessment found several positive findings about the Avicenna HIS that are presented below:

1. The Avicenna HIS is in active, continuous use in every hospital where it has been deployed. It is heavily relied upon for basic patient management in the units/departments and for hospital administrative decision-making, reporting and costing.
2. PMOH DG of Hospitals, Dr. Mohammed Abu Ghali, hospitals directors and middle managers expressed considerable enthusiasm and buy in for the system and they report frequent use of Avicenna HIS data to inform resource allocation decisions across hospitals.
3. Facilities using Avicenna HIS cite an increased ability to track the number of patients seen. Prior to implementation providers would see patients off the record (relatives, friends, patients from their private clinic). With the Avicenna HIS the hospital directors are aware of which patients have been seen each day and appreciate the instantaneous sharing of information between hospital units and hospitals.
4. Strong and well-skilled champions exist within the PMOH IT group and Avicenna HIS users.
5. The Avicenna HIS has high visibility across the West Bank. Facilities without it (4 remaining PMOH hospitals, 1 mental health and 8 primary health care directorates) are requesting to be put on the 'wait list' for implementation. Many have been visiting Avicenna HIS-enabled facilities in preparation for their own implementation.
6. Leveraging the centralized Avicenna HIS implementation at the PMOH Data Center, a national-scale, unique patient ID has been started.

Gaps

Several common themes regarding areas of improvement and gaps emerged from the assessment visits and meetings. Areas of improvement repeatedly mentioned include:

Lack of PMOH Ownership. The Minister of Health does not appear to be supportive of the HIS according to the PMOH IT unit and as evidenced by the lack of funding that PMOH has provided for HIS. Without his explicit support for financing the system, it is likely impossible for the PMOH to step up as the clear and unambiguous "owner" of the Avicenna HIS (including funding the ongoing maintenance, support and operation of the system.)

Absence of digital health framework. It is important for PMOH to establish and lead the governance of Palestine's overall digital health strategy and to enact the appropriate policies and legislation needed to support it.

Insufficient data quality. Clinical data quality in the HIS (e.g. coded diagnoses, procedures, orders, etc.) is generally regarded as poor. The main reason for that is the lack of training especially on the ICD10cm diagnoses, lack of human resources (e.g. doctors, nurses, medical secretary) and the limited amount of time spent with a large number of patients in the outpatient clinics that impedes health care providers ability to enter high quality data. Additionally, the system lacks basic validation checks that could prevent out of range, blank or inconsistent data entries that contribute to poor data quality and less utilization of Avicenna HIS data as a result.

Although administrative benefits are being realized from the HIS, without improved data quality it will be impossible to realize important care quality and clinical efficiency benefits. Poor data quality impedes the ability to leverage the Avicenna HIS to improve referral workflows.

Inadequate technical support and absence of a Help Desk. Many of those interviewed complained of poor responsiveness to technical support requests (JIRAs). A backlog of reported system issues/JIRAs exists spanning a few years without resolution (see Appendix E for an example). Categorization, points of contact for issues management, and lack communication and timely follow-up were universal concerns. Communication between the support organizations (Dimensions/DataSel) and the facility users has been very poor. DataSel is a subcontractor to Dimensions. A strained relationship between DataSel and Dimensions/Ultimatat exists that has negatively impacted implementation and especially issue resolution. Dimensions identified a number of support tickets as frivolous, others were categorized as “feature requests” (not bugs) that would require additional funding before being addressed, and many issues were identified as ones that DataSel needed to resolve.

Inability to customize reports and user interfaces. Stakeholders noted that the Avicenna HIS does not allow them the ability to customize user screens or generate customized reports. As evidence, many JIRA tickets relate to customizations to Avicenna’s data entry forms and reports. The difficulty and inability at all levels to generate Avicenna HIS reports, make system changes, apply pre-entry validation checks and generate dynamic forms is a major concern. To a large extent, this results from a lack of sufficient administrator privileges at facility level that DataSel has yet to provide. It is unacceptable that a facility such as Rafadia with its expert IT staff and history of long usage (4+ years) does not have adequate system privileges.

Challenges in integrating the Avicenna HIS with 3rd party applications and with medical devices. The current system does not allow for establishing interoperability with other information systems. As evidence, a number of the open system issues (JIRA tickets) pertain to challenges in connecting 3rd party applications and external devices to the HIS Avicenna software. This lack of interoperability with medical devices, lab equipment and with other systems (such as MS Access based billing, the SPD web based referral application and referral management database, UNRWA’s EHR, the reproductive health system to be implemented by WHO, DHIS2 tracker) limits the potential value of Avicenna HIS in the overall health information ecosystem.

Implementation costs and sustainability. The HIS implementation costs incurred by Flagship project and how these relate to actual procurement and service provision is not always clear. Staff at the facility level (mainly the directors) expressed repeated concerns regarding Avicenna HIS sustainability in terms of who will pay for and support system upgrades and maintenance and provide replacement equipment and training.

New Facility Implementation Status (readiness)

There are four PMOH hospitals yet to be provided with Avicenna HIS. This assessment examined the readiness of these facilities for Avicenna HIS implementation. Appendix E summarizes the hospitals on the wait list in terms of background and status.

Factors used to measure facility readiness for Avicenna HIS implementation included:

- Facility staff buy-in and/or resistance of change, experience with the Avicenna HIS in general, computer literacy, availability
- Building architecture and infrastructure in general, availability of training rooms, working rooms
- Technical infrastructure, connectivity with the Data Center, computer network, server room, available equipment (e.g. PCs, Laptops, Printers)

Four PMOH hospitals are on the waiting list to have Avicenna HIS implemented and all four hospitals (Directors and staff) are eager to have Avicenna HIS implemented as soon as possible. Most of them have staff with Avicenna HIS experience having served previously in Avicenna HIS enabled facilities. These 'advocates' realize the benefits of the Avicenna HIS and have put in place structures in advance to support Avicenna HIS when implemented such as quality assurance staff and networking. The hospitals are considered qualified to have the Avicenna HIS implemented, Hospitals readiness is detailed below (more details can be found in Appendix D):

1. **Tulkarem (Thabet Thabet) Hospital** was assessed to be ready in 2014 but Avicenna HIS has not yet been implemented due to timing (Flagship end). This facility would benefit significantly from Avicenna HIS and is the largest in terms of number of beds, number of staff, patient traffic and specialties among the four PMOH hospitals remaining. It provides essential health services and specialty care for over 200,000 people and recently opened a maternity ward. The hospital is ready in terms of facility staff. Buy-in is high and there appears to be no resistance to change. More than 25% of the staff has Avicenna HIS experience and Computer literacy. Staff availability is considered to be in good shape. The building architecture and infrastructure in general is good, and training rooms and working rooms are available. Gaps that would need to be addressed include the lack of technical infrastructure, such as no connectivity with the data center, no computer network or server room, no PCs, laptops, or printers.
2. **Al Wattani Hospital** in Nablus comes next in size. It is an old facility and consists of dispersed, rundown buildings, some of which are under renovation. It is one of a few cancer hospitals in the West Bank. The potential of Avicenna HIS to improve drug management in this hospital could have significant benefits as lack of drugs is often a cause of outside referrals and control of drugs at this hospital will have significant impact on the drug cost saving (control the waste/damage/misuse) given oncology drugs are very expensive. Facility staff buy-in is high and more than 20% of the staff has Avicenna HIS experience. Computer literacy and staff availability is considered to be in good shape. The Building architecture and infrastructure is going to be difficult but can be managed. Training rooms and working rooms are available. There is no technical infrastructure, including connectivity with the Data center, computer network, server room, PCs, laptops, or printers. All technical infrastructure will need to be procured.
3. **Tubas Hospital** was built and equipped by the Turkish Government. It was opened for operations in May 2014 and provides essential services to a large dispersed geographic

area. Despite the fact that few units are still not functional it seems to be a very busy place. It is already equipped with a computer network, computers, and printers, and is considered the most ready one in terms of infrastructure. The PMOH IT staff assessed the hospital to try to implement Avicenna HIS by themselves however they could not start due to lack of some equipment that could not be funded by the PMOH. The server and other hardware need to be procured before the implementation starts.

4. **Yatta Hospital (Abu Hasan Alqasem)** is new and small in terms of number of beds, staff, and patient volume. Yatta hospital is emerging and some departments and clinics are on hold. No local storerooms are available (e.g. supplies, drugs are all stored in hallways). The hospital staff expressed buy-in for Avicenna HIS implementation. Some of the staff has Avicenna HIS experience, and staff are available who have good computer literacy. The building architecture and infrastructure is new and easy to work with and training rooms and working rooms are available. Technical (hardware) infrastructure is lacking and infrastructure will need to be procured.

Strengths and Successes of Avicenna HIS

Avicenna HIS has provided health information where none existed previously and it is used on an hourly basis. In numerous cases the Hospital Director uses the system. In other cases the Administrative Director or lead clinicians reported high usage and reliance on the system the day to day hospital's work. The Data Center central storage model for all PMOH facilities has enabled access to information at the various levels including the central level. The DG of Hospitals accesses hospital wide data to enable resources and budget planning at hospital and central levels. The PMOH IT team of 30 staff has established a strong level of ownership and troubleshooting as well as can be expected given their limited systems administrator privileges.

While there are areas to be enhanced and gaps to be addressed, the high use of the system in administrative activities and in day-to-day planning is highly beneficial. Indeed, all interviews with doctors, nurses, registration staff and others indicated a consistently high utilization of the system.

Avicenna HIS strengths reported by the hospitals:

- High availability, working 24/7
- Unique medical record accessible over all governmental health facilities where Avicenna HIS has been implemented. Cost savings on drugs, medical consumables, space and stationary due to control and accountability
- Ease of administration and system management and control
- Medical staff indicated they felt system use led to reduced medical mistakes
- Data safety given that data is protected against loss and damage
- Distribution of roles and responsibilities between Doctors and Nurses defined well, before the Avicenna HIS it was a mess, nurses were doing some of the doctors' activities (e.g. order lab tests, drugs ...); nurses feel more comfortable with Avicenna.

- Easy reporting for strategic planning and facility level decision-making (e.g. resources reallocation, budgeting, bed management)
- Comprehensive system for all hospital departments, medical, nursing, technical, financial, and administrative services
- A tool of effectiveness & efficiency, reduced over all patient waiting time and the patient traffic among the hospital departments, better tracking and allocating resources, greater access to data for patient care, improved quality of care because of control and accountability.
- Enhanced communication (messaging module and automated workflow) and transparency among the hospital departments and other governmental hospitals under Avicenna HIS.

Other Successes observed:

- System usage means drastic reduction of paper and/or some paper-less mode for inpatient and outpatient records.
- PMOH IT staff reside in most facilities to ensure the system is operational and provide first level of support to hospital staff.
- Quality Assurance program and good quality data exists in Alia hospital in Hebron and could be used as a model for others.

Opportunities for Improvement / Current Gaps

Some of the gaps in the current system relate to the fact that Avicenna is a proprietary, commercial software product. PMOH does not have the software source code. This has created challenges regarding the support and enhancement of facility implementations, including:

- Ad hoc reporting is not easily done and most often requires an issue ticket request to Dimensions who in turn contacts DataSel to act on the request.
- Lab and medical devices integration is mostly hardcoded in the system.
- While DataSel has trained PMOH and Dimensions staff in the Avicenna HIS system, software code modifications must be done by DataSel. The current system version does not provide for a software developers interface / kit (SDK).
- PMOH does not have sufficient administrative privileges to extend the system past its current version.
- DataSel cannot - for free - afford to undertake software enhancements. Development of new features to satisfy requests by the PMOH facilities users and many other issues and requests have gone unaddressed because the PMOH cannot fund.
- The software version implemented has become obsolete and has not been upgraded as new versions of the core Avicenna software have been released by DataSel.

Avicenna HIS improvements. Key Avicenna HIS usage and functionality issues reported by facility level staff and the PMOH IT staff to Dimensions through the JIRA log tracking system are listed in Table 1 below as 'requirements'. PMOH IT and hospital staff would like to see this list addressed in the next version of Avicenna HIS. These should be seen as opportunities to

increase Avicenna HIS use and effectiveness and garner further support from users through incorporating their feedback in designing improvements to the system.

Table 1. Avicenna HIS unmet needs/requirements

Avicenna HIS Requirement	Responsible Party
PHIC Reports / Statistical Reports: Various reports requested by the Palestinian Health Information Center (PHIC) need to be developed or customized within Avicenna.	Dimensions/DataSel
Generate statistical reports from Avicenna forms: To give value for the forms that the users fill out in Avicenna and attached to the medical record (other than the data entry screens), statistics need to be generated for facility reporting purposes and PHIC annual report.	Dimensions/DataSel
Administrative Tasks Handover: Many tasks are not yet handed over to the PMOH IT team. They require higher system administration access. The PMOH should reach a point where they can do all administration required on the system (e.g. a- defining a new facility on the system, b- manipulating the price list, c- build a testing or training environment and few others)	Dimensions
Sterilization sets: In the sterilization department, workflow changes and adjustments are needed to allow the use of tools sets and not only tool by tool inventory management.	Dimensions/DataSel
Attachments: This feature exists in the current version deployed but is not yet enabled. This feature is usually used to attach documents such as hardcopies of medical reports coming from non-Avicenna HIS hospitals/clinics or diagnostic reports.	Dimensions/DataSel
Forms: Editing the data entered into a form by different facility users when needed, This is important for editing the referral form instead of having multiple forms at each stage of the referral process	Dimensions/DataSel
ICD10cm: Training for doctors on how to retrieve the right ICD10CM Diagnoses is needed. Users complained about missing diagnoses as they don't know how search the long list of the ICD10cm codes given the sheer number of codes (tens of thousands). DRG codes will also need to be added to the system to facilitate the referral process.	PMOH
Avicenna Release notes: PMOH IT needs to be informed and have the new release notes documentation available before the deployment of any patch or new release to the Avicenna HIS is running on the production environment	Dimensions/DataSel
System Openness and Interoperability: Application programming interfaces (APIs) are badly needed to integrate the referrals management system, referrals web based application, Ministry of Interior, Insurance department and other management information systems that might be deployed in the future in the country.	DataSel

PACS: Picture archiving and communication system is needed.	PMOH
Maintenance Contracts: Currently and soon to be lapsed hardware warranties and software licensing including Oracle, Avicenna, Antivirus, PCs and peripherals need to be renewed. These lists have been requested from CMC but are not yet available.	PMOH

Linking Avicenna HIS with other systems. Integrating other systems with the Avicenna HIS will require enhancements to the system to provide for interoperability and data exchange. There are at least three systems that would benefit if interoperability were established with the Avicenna HIS. These are noted below:

- **Referral management system.** Presently the Avicenna HIS does not exchange data with the SPD referral management system. The SPD referral management system and web based application also need strengthening. At the very least however the ability to send data from Avicenna HIS to SPD could avoid the need to duplicate data entry. The HIS user interface could also be enhanced to better support the referral process as described earlier. These will be issues that need to be resolved through developing APIs to facilitate data exchange
- **MenaHR integration.** The MenaHR system previously chosen by the PMOH as the national level human resources information system requires an assessment as a next step so that interoperability with the Avicenna HIS can be planned.
- **DHIS 2 RH.** The Palestinian National Institute of Public Health is customizing the DHIS 2 for the Maternal Child Health program at the PMOH PHCs. Integration of the system with the Avicenna HIS is considered vital for the sake of sharing the same medical record among the PMOH facilities and in the future nationwide.

Data quality enhancements required. Data quality and data use are intricately linked. To improve the use of health information, there must be confidence in the data by Avicenna HIS users. Tackling Avicenna HIS data quality concerns should start immediately with data quality audits. Users should also be engaged to identify champions to assist with enhancements.

To improve data use, PMOH IT and other Avicenna HIS users could utilize tools in existence including the MEASURE Evaluation Guide to Improve Data Use (11). Appendix H presents the MEASURE logic model for strengthening the use of health data in decision-making.

RECOMMENDATIONS

Overcoming the gaps and issues identified by the present assessment should be regarded as an opportunity to liberate even greater value out of the investments that have already been made. This section describes the recommendations for strengthening Avicenna HIS and highlights immediate actions required with indications of why they cannot wait. Recommendations are categorized into Phase 1, 2, 3. A phased approach is recommended so the system issues and enhancements for openness can take place before further implementation activities occur.

Detailed recommendations are set forth in Appendix K. Highlights of each phase are summarized below.

Phase 1. (Immediate Priorities for Action)

In this phase the focus would be on solidifying support for the Avicenna HIS as a critical component of a digital health strategy. The technical elements to be addressed in this phase include addressing Avicenna HIS issues management, strengthening the data center and disaster recovery functions, developing enhancements to integrate with other systems, building the capacity of PMOH to sustain the system, and promoting data quality and use.

Recommendations include:

1. A meeting that includes the USAID and/or PHCP should be convened with the Minister of Health to update the Minister regarding the assessment's findings and to garner overt support for the Avicenna HIS and the foundational role it will play in supporting an overall Palestinian digital health strategy.
2. The PMOH IT Director should be advised and supported to develop the necessary budgets, needed training and transition plans to sustain the Avicenna HIS system and plan for its expansion to other PMOH facilities. The PMOH IT Director could be provided with a secondment to this group to act as a capacity building manager (second in command).
3. The PMOH will require assistance in establishing and managing the governance needed to develop a national digital health strategy. This digital health strategy would include legal, regulatory and policy guidelines and procedures. A technical working group could be established to bring high level support for developing this strategy.
4. A strengthened technical support capacity is required for PMOH IT to take on the functions that were provided by Dimensions. The PMOH IT Director should be assisted in establishing an active knowledge management strategy and a toolset to do this. Additionally, the PMOH IT group's knowledge management and communications capabilities should be supported to promote the Avicenna HIS's implementation's successes that have in the past been under-reported. There is an opportunity to develop a vibrant community-of-practice regarding this important "cornerstone" in a Palestinian digital health strategy.
5. Avicenna HIS maintenance, Super Admin rights, system licenses and Data Center operation should be immediately transitioned from Dimensions to the PMOH IT team. As a practical matter, to ensure continuity, it is recommended that Dimensions' contract, expiring September 30, 2015, be renewed as a transitional contract by quarter until such time as the transition to the PMOH is complete.
6. In order to address the significant number of pressing issues related to Avicenna integration and customization, the PMOH IT Director should be assisted in specifying an issue management tool, a work plan and negotiating a contract with DataSel to complete the needed Avicenna software functionality modifications. This could include financial support.

7. Assistance should be provided to the PMOH to develop training programs and quality assurance tools (e.g. custom reports, data quality audits) that will support a data quality improvement initiative. Execution and operationalization of this initiative should be led by the PMOH QA team.
8. The PMOH IT Director should be assisted to coordinate interoperability with related programs (e.g. SPD's web-based referral application and referral management system, MENA HR,WHO RH initiative (DHIS 2), World Bank UHC initiative, Unrwa, etc.). The scope of this effort should include both technical cooperation and donor funding cooperation/pooling and utilize an open architecture approach such as OpenHIE.

Phase 2

Recommendations in this phase focus on sustaining efforts identified in Phase 1 and implementing improvements to the Avicenna HIS in existing facilities. In Phase 2 the system can also be rolled out to Tulkarem Hospital. Actions include:

1. Strengthen the Avicenna HIS in existing facilities, sign maintenance contracts, apply new fixes and customizations, and refresh the hardware in use.
2. Leveraging the assistance of the seconded manager, the PMOH IT Director should assemble a project team and contribute to the implementation of the Avicenna HIS at the first of 4 remaining hospitals starting with Tulkarem with reasonable support from DataSel and/or another subcontractor. The scheduling of these implementations will depend upon the timing of work required for integration and customization fixes applied to the Avicenna HIS. The new Avicenna HIS rollouts should include the fixes and software enhancements needed in the Avicenna product before implementation in other facilities. Consideration should also be given to rolling out different hardware technology (e.g. thin-client computers/N-computing, client-server) as a lower-cost and more sustainable hardware architecture option.

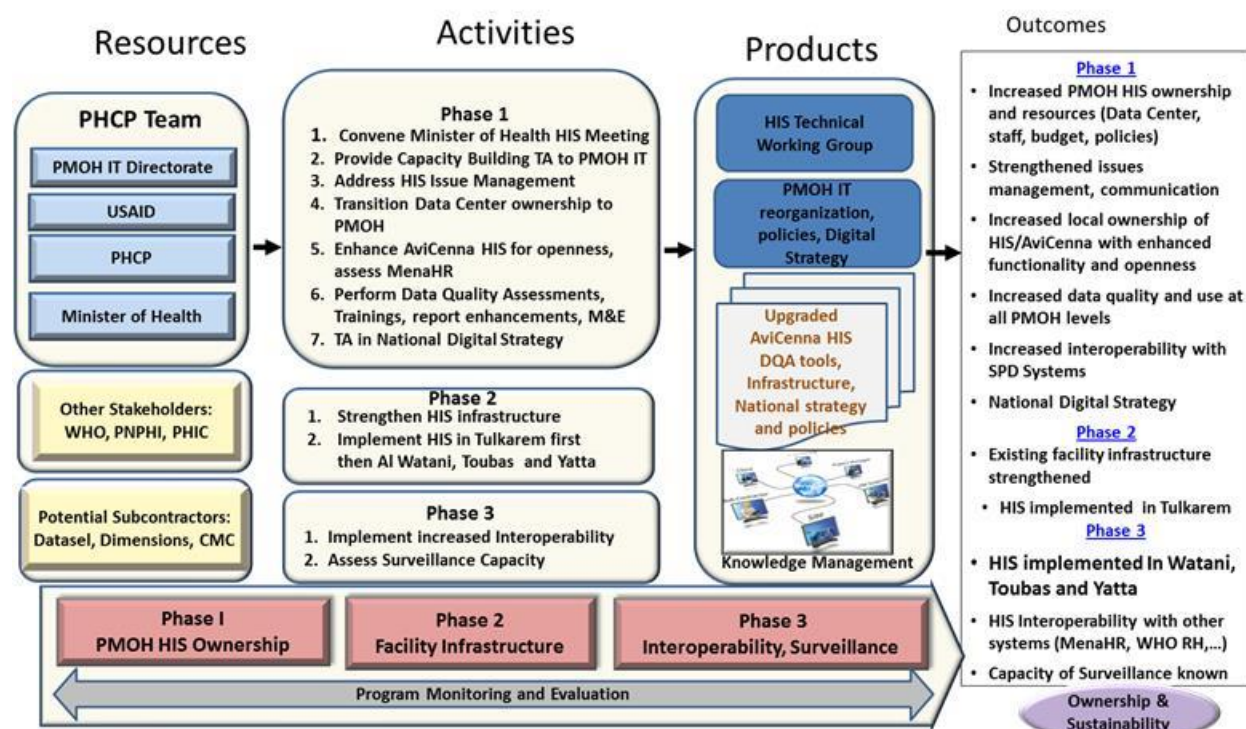
Phase 3

This phase will include implementation of Avicenna HIS in the three remaining facilities. A further focus in this phase will be to improve information exchange and interoperability between Avicenna HIS, referrals and other systems including WHO Reproductive Health system. By phase 3 PMOH should be well positioned to consider further leveraging the value of the HIS to assess its capacity for national level surveillance and reporting of diseases. Specific actions include:

1. Continue with new facility implementation – three remaining facilities
2. Continue to enhance the system to support Information exchange and interoperability with related programs (e.g. MENAHR, WHO RH initiative (DHIS 2), World Bank UHC initiative, UNRWA) through development of application program interfaces.
3. Assess capacity of Avicenna HIS to support disease surveillance and reporting.

Figure 3 presents the Avicenna HIS logic model that describes the outcomes to be achieved if the Phase 1-3 recommendations are implemented. A strengthened Avicenna HIS will strengthen the capacity of PMOH to collect, organize, maintain and use electronic data to support the provision of quality health services.

Figure 3: Avicenna HIS Logic Model



Risks

This assessment has identified that the most glaring risk is the risk of inaction coupled with the need for ownership of the Avicenna HIS within the PMOH. Professional project management and risk mitigation techniques are available to address the risks associated with all of the recommended activities. To not proceed with the proposed recommendations, however, puts at risk the benefits that have already been realized by the Avicenna HIS implementation. Specifically, the present lack of “ownership” of the system by the Minister and by the PMOH (organizationally) must be addressed. Without PMOH ownership, it is unlikely any other aspect of the recommended plan of action could succeed. Equally – without the rest of the plan of action, it is unlikely the PMOH will be able to successfully take ownership.

Health information exchange and interoperability between systems are critical for a strong health information ecosystem. Risks in not addressing this component means that various systems will exist in silos, information will be duplicated, and information not exchanged.

Avicenna HIS is not an open source software, which limits the PMOH procuring the customizations from any other vendor. As a result, it may not be in a strong negotiating position when required to procure services from DataSel.

CONCLUSION: WHAT DOES SUCCESS LOOK LIKE?

Success occurs when roles and responsibilities are fulfilled in a way that engenders confidence and trust in the system and garners high usage. While there is much to leverage from what is already in place, and in applying international best practices to standardize and address gaps, the success story continuing to unfold for Avicenna HIS will need to be written largely by the PMOH leadership and its IT Directorate empowered by technical assistance. It will entail building upon current structures, enlisting champions, shoring up high level support by the Minister, increasing technical capabilities, enhancing the Avicenna HIS software to expand openness, functionality, data quality, and usage. All of this will indeed lead to local ownership and sustainability, if the resources and political will are available.

What does a successful Palestinian Avicenna HIS environment look like? Common characteristics of a well-functioning, high quality Health Information System widely accepted and used for decision-making at all health levels are listed in the table below as best practices. These best practices are matched with a vision of what a successful Palestinian HIS would look like.

Table 2: HIS Best Practice and Vision of Successful Palestinian HIS

HIS Best Practices	Vision of a Successful Palestinian HIS
<p>Enabling environment with support and buy-in from the top</p> <ul style="list-style-type: none"> PMOH ownership and authority, leadership of others including NGOs that are involved Strong policies and leadership in ICT, IT, Avicenna HIS Established standards and norm accepted by the PMOH and stakeholders 	<p>PMOH Capacity Building and Ownership</p> <ul style="list-style-type: none"> Minister of Health support and buy-in Annual PMOH IT budget Reorganized and empowered PMOH IT Directorate PMOH IT Directorate leading national Avicenna HIS TWG that meets routinely and sets overall Standards and Interoperability Guidelines Standards established by PMOH Stakeholder access to standards (online, trainings) with direction for health information systems Digital Health Strategy ICT national policies
<p>Culture of inclusion and active engagement of various stakeholders</p>	<p>Data Demand and Information Use</p> <ul style="list-style-type: none"> Inclusion of various national and community level, donors, NGO in the formation of the Avicenna HIS TWG Enhanced communication, distribution lists, knowledge management
<p>Provides needed information to those who need it, quickly</p>	<p>Avicenna HIS Enhancements</p> <ul style="list-style-type: none"> Avicenna HIS highly accessible Utilized by hospital directors, central and facility level staff

<ul style="list-style-type: none"> • Synergies and stimulations: Leveraging other donors, work to scale up Avicenna HIS further 	<ul style="list-style-type: none"> • Stakeholders have Avicenna HIS access privileges needed, Business Intelligence/Dashboards, Reports • Capitalize on RH 400 rollout; identify donors to further scale up PMOH facilities
<p>The system meets the differential needs of its various subgroups</p> <ul style="list-style-type: none"> • Learning opportunities, online/eLearning material 	<p>Completeness of Avicenna HIS</p> <ul style="list-style-type: none"> • System requirements for reporting and content developed by user community via workshops, feedback, focus groups • System access policies for user roles established and administrated
<p>Data use, high quality data, active monitoring and success stories, open communication</p> <ul style="list-style-type: none"> • Provides for unique patient reporting, and into aggregate systems for sub national and national reporting • Issues heard and resolved – e.g. well managed • Real time, high quality data used for a multitude of purposes including program planning, clinical decision support and administrative/ resource allocation • Feedback loop and corrective mechanisms exist, program evaluations, surveys, self-assessments 	<p>Data Quality, Monitoring and Evaluation and Surveillance</p> <ul style="list-style-type: none"> • Avicenna HIS Community of Practice with facility level champions identified • Identified KM/communications specialist drafts success stories • Utilize Data Center for patient level aggregate reporting / Data Warehouse and indicator reporting • Develop and provide monitoring tools of aggregate reports • Establish strong Issue Management, feedback from sites monitored, involve M&E staff • Widespread Avicenna HIS system use for both administrative and clinical purposes
<p>Integral part of the larger health system ecosystem and digital health framework</p> <ul style="list-style-type: none"> • Information flows between systems and subsystems • Referral Avicenna HIS integration via web interface 	<p>Digital Health Strategy and Interoperability</p> <ul style="list-style-type: none"> • Digital Strategy established • Interoperability guidelines established with systems and subsystems adhering • Established Palestine Avicenna HIS Enterprise Architecture • Central to facility level feedback loop, data collection performed routinely (3,6,12 month intervals)

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APPENDICES

Appendix A: List of PMOH and NGO Facilities with USAID-Supported Avicenna HIS

Location	Type	Name	Completion Date
Nablus	MOH Hospital	Rafidia Hospital	February 2011
Qalqilia	MOH Hospital	Dr. Darwish Nazal Hospital	May 2011
Hebron	MOH Hospital	Alia Hospital	June 2011
Ramallah	MOH Hospital	Bahrain Hospital	May 2012
Ramallah	MOH Hospital	Palestinian Medical Complex (Al Sheikh Zayed Hospital, Sons of Ramallah Hospital, National Blood Bank, and Kuwaiti Hospital)	June 2013
Beit Jala Hospital	MOH Hospital	Beit Jala Hospital	June 2014
Jericho	MOH Hospital	Jericho Hospital	August 2014
Jenin	MOH Hospital	Jenin Hospital	September 2014
East Jerusalem	NGO Hospital	Al Makassed (phase I only)	October 2014
Nablus	Warehouses	MOH Central Supply Warehouses	October 2014
East Jerusalem	NGO Hospital	Saint John Eye Hospital, Hebron and Anabta clinics, plus outreach services	September 2015 (estimated)
Bethlehem	NGO Hospital	Caritas Baby Hospital	September 2015 (estimated)
Nablus	MOH Clinic Level 4	Nablus Primary Health Care Directorate	February 2011
Qalqilia	MOH Clinic Level 4	Qalqilia Primary Health Care Directorate	June 2011
Qalqilia	MOH Clinic Level 3	Azzoun Clinic	July 2011
Hebron	MOH Clinic Level 4	Al Karantina Clinic	October 2012
Ramallah	MOH Clinic Level 4	Central Ramallah Clinic	November 2012
Ramallah	MOH Clinic Level 3	Beit Rima Clinic	November 2012
Hebron*	MOH Clinic Level 3	Tarqumia Clinic Knows Avicenna HIS well	November 2012
Ramallah	Offices	Central Ministry of Health (including Central Warehouses, Finance Department, Referral Department, and Secondary Health Care Directorate)	December 2013

Appendix B: Findings Summary for USAID-Supported Avicenna HIS Facilities

#	Location	Hospital Type	Facility and Avicenna HIS implementation date	Summary of Findings	Assessment Visit Date
1	Nablus	MOH	Rafidia Hospital February 2011	<p>Background: First Avicenna HIS implemented hospital, used to have many success stories but still suffer from the outstanding issues and the lack of responsiveness of the support teams, have a strong experienced PMOH IT team, one of them is Avicenna HIS administrator.</p> <p>Staff: The Hospital Director is new and not involved in the Avicenna HIS. Admin Director was one of the identified 'Avicenna HIS champions' since the early beginning of the Avicenna HIS implementation.</p> <p>Status: Avicenna HIS is in use in all hospital wards and departments, but they want the PACS system installed.</p> <p>All the hardware is out of warranty and need a maintenance contract.</p> <p>The Avicenna HIS administrator need full privileges and training on the system for better support.</p> <p>They have 52 open issues with Dimensions some of them were open for about three years.</p> <p>No Quality Assurance initiatives.</p>	July 22, 2015
2	Hebron	MOH	Alia Hospital March 2013	<p>Background: Avicenna HIS is in use in all hospital wards and departments, they want the PACS system installed, concerned about the sustainability of the system by the PMOH.</p> <p>Staff: The Hospital Director and Avicenna HIS team showed solid Avicenna HIS teamwork. Strong IT and Quality coordinator team</p> <p>Status: Good Quality Assurance; The medical and Admin Directors work with the Quality Coordinator to obtain indicator reports to enhance data quality and users performance. The hospital is expanding, current number of beds is</p>	August 2, 2015

				300 and will reach 370 by the end of the year, a new MRI machine had been installed, and building expansion is underway. Most of the hardware is out of warranty. This site could be model for others in terms of QA and M&E.	
3	Ramallah	MOH	Palestinian Medical Complex (PMC) June 2013	<p>Background: large, fairly new hospital complex contains Al Sheikh Zayed Hospital (Emergency wing), Sons of Ramallah Hospital, Bahraini Hospital (Pediatric wing), National Blood Bank, and Kuwaiti Hospital (Cardiology wing). The Avicenna HIS Data Center housed in lower floor of PMC.</p> <p>Staff: Lack of IT staff. Staff need retraining on extracting the needed reports.</p> <p>Status: Some wrong data exist because of operational mistakes, system inability to change data. System needs to be tuned to fit with some specialties workflow. Need training on ICD10cm Diagnoses retrieval difficult; electrical outages fairly frequent and they only have few UPSs in the wards. Some Hardware out of warranty. Error in the Pharmacy and accounting module not resolved.</p>	August 11, 2015
4	Beit Jala	MOH	Beit Jala Hospital June 2014	<p>Background: Also a specialty hospital: is an oncology referral hospital in the south, they asked for special customized workflow for the oncology wards, still pending with Dimensions.</p> <p>Staff: The Hospital Director and the Admin Director are champions on the system; they have 3 good IT staff and receive support from the Avicenna HIS administrator at Alia IT as well.</p> <p>Status: Avicenna HIS is in use in all hospital wards and departments; they also would like the PACS system installed. Most of the hardware is still under warranty.</p>	July 28, 2015
5	Jericho	MOH	Jericho Hospital August 2014	<p>Background: relatively small hospital with 53 beds, located in Jericho in the Jordan Valley.</p> <p>Staff: Part time IT staff</p> <p>Status: Not yet assessed. Contacted via phone to schedule visit. General understanding is that most of Avicenna HIS hospitals concerns and issues are like Salbit hospital (similar in size and functionality).</p>	To be assessed
6	Salbit	MOH	Yaser Arafat Hospital	Background: The hospital is located in Salbit Governorate in the middle of the west bank. It is	August 16, 2015

			July 2014	<p>relatively a small hospital with 55 beds, but has most specialties including operations theater. The Hospital Director believes that the two main reasons of bad quality data, is the lack of human resources and the lack of training.</p> <p>Staff: Very harmonized team, the IT lead (Isra) stated she responds and resolves up to 80% of the users' support, the rest need Dimensions/DataSel interfere. Hospital.</p> <p>Status: Has requested additional 10 computers from the PMOH budget to be used as a backup, Hardware is in good conditions and still under warranty. Avicenna HIS in very active use.</p> <p>System functionality: staff faces difficulty in finding the right diagnoses in list in Avicenna HIS.</p>	
7	Jenin	MOH	Jenin Hospital September, 2014	<p>Background: The hospital is located in Jenin Governorate in the north of the west bank. It is a mid-size hospital with 127 beds, it has most specialties including operations theater, it was the last hospital to implement the Avicenna HIS before the Flagship closing.</p> <p>Staff: The Hospital Director and Admin Director have the buy in to the Avicenna HIS, Strong Avicenna HIS Administrator (woman) do all the IT support.</p> <p>Status: Weak coverage of the Wireless access in the gynecology ward, continuous power outage during This summer causing continuous work maintaining the PCs Operating system (60% of the computers are covered with UPSs), no team work among the hospital management from one side and the Avicenna HIS engineer on the other side, Some Hardware is getting out of warranty (laser printers) and most others (Computers) are in good conditions and still under warranty.</p>	August 12, 2015
8	East Jerusalem	NGO	Al Makassed (phase I only) October, 2014	<p>Background: Phase1 was through Flagship, they continued with Dimension and DataSel on separate agreement via a USAID grant.</p> <p>Staff: they got very professional CTO. They still in need to more technical support staff</p> <p>Status: Strong use of Avicenna HIS, especially by CFO who has staff and utilizes Avicenna HIS for administrative and clinical purposes. Developed MS Access export routine and reports. Referrals managed and controlled.</p>	July 27, 2015

				Working directly with DataSel, visited Ankara on Thursday August 20 th , 2015 to discuss them with the technical teams at DataSel.	
9	Nablus	Warehouse	MOH Central Warehouse October 2014	<p>Background: Warehouse considered using Avicenna HIS but went with a more specific warehouse software system.</p> <p>Status: Does not utilize the Avicenna HIS nor exchange information with the system. The warehouse Director indicated that the Dimensions approach was not to migrate the legacy data from the old system was unacceptable. The warehouses recently upgraded their current system (Oracle based with available source code) and the PMOH decided to continue on it as per the PMOH IT manager Ummayya Abu Shanab.</p> <p>PMOH IT Director also confirmed that the minister decided not to use the Avicenna HIS warehouses module in the central warehouses.</p>	July 22, 2015
10	Bethlehem	NGO	Caritas Baby Hospital September 2015 (estimated)	<p>Background: Not in Flagship, received separate USAID grant and spent two years accessing Avicenna HIS, requirements, back and forth with Dimensions. Visited other Avicenna HIS implemented facilities to understand Referrals. More manageable and controlled.</p> <p>Status: Still in testing phase, to go live in next 2-3 months. Indicated it took Dimensions considerable time to get to them/work through the process. Felt Dimensions implementation only one facility at a time hence the delay.</p>	July 28, 2015
11	Ramallah	Data Center	Ramallah PMC Data Center	<p>Background: Data Center location is the ground level of Kuwaiti Hospital in the Palestine Medical Complex.</p> <p>Staff: Dimensions runs the center after their contract ends September 30, the DC will be under the PMOH responsibility, PMOH IT is involved in the Data Center, interacts with Dimensions staff regularly but no handover to the PMOH happened yet.</p> <p>Status: Data Center access controlled at 2 entry points within the building. Card access is needed to enter the general area and work room. Servers are in an additionally secure area for servers with only 3 staff having access to the server room, Cameras and alarm system is present.</p>	July 26, 2015

				<p>Data Center uptime was observed as 99.39%. (For the past two months).</p> <p>The Data Center has UPS housed within, is reliant on the hospital power for primary, the hospital has a backup generator.</p> <p>No data loss has been recorded in the History of the DC.</p> <p>Virus protection is updated weekly. Previously there has not been any attacks (such as denial of service) but viruses have occurred and been dealt with.</p> <p>HR MENA server is near capacity and more storage is needed.</p> <p>Additional points of risks that can at any time cause down time:</p> <p>Dual power feed to all servers is in need, Backup Power source currently is the hospital generator, there should be identified back-up for DC staff when not available and there should be emergency contact numbers on hand (PMOH).</p> <p>Other findings include: aging servers and will need to be replaced. An equipment refresh plan should be drafted.</p>	
12	Nablus	Disaster Recovery / Backup Site	DR in Rafidia Hospital	<p>Background: Exists within Rafidia Hospital in Nablus as Avicenna HIS Data Center backup with continuous data update from Data Center.</p> <p>Status: Dimensions maintains under flagship contract until Sept 30, 2015 as a 'backup' and not active cut over/hot site. PMOH expressed it should be a live site intended to cut on immediately in case of outage. It does not appear to be doing that now.</p> <p>Additional information requested from Dimensions to be sent to PHCP:</p> <p>DC and DR Architecture Diagrams, Information on the Disaster Recover Site, Internet provider have a single connection, Should have two different internet provider vendors for effective redundancy.</p>	

Appendix C: Avicenna HIS Flagship incurred costs

Avicenna HIS Activity	Total Price
Avicenna Software (development?)	\$2,923,691.70
Avicenna open license for PMOH and NGO facilities in the West-Bank and East Jerusalem.	\$1,760,000.00
Hardware	\$4,890,608.56
Implementation of Tasks, including Year 1 & Year 2 System Support and Maintenance	\$3,388,469.66
250 hours of enhancement and modifications at \$120.00 per hour	\$30,000.00
Data Center and DR back-up site hardware and installation	
Maintenance and support to the PMOH of the Avicenna Software (Year 1 and 2)	\$150,000.00
Stop Work Order equitable adjustment	\$129,440.00
Customization of Avicenna to meet the Central Warehouse needs	\$115,200.00
Extended warranty for critical servers and switches (Task 12)	\$136,061.00
MenaHR	
TOTAL FIXED PRICE	\$13,523,470.92

Appendix D: Hospitals on the Avicenna HIS Implementation Waitlist - New Implementations

#	Location	Type	Name	Number of Beds	Number of Users	Finding	Contacts
1	Tulkarem	MOH Hospital	Tulkarem/ Thabet Thabet hospital	122	280	The largest hospital among the 4 hospitals listed in the table in terms of number of beds, number of staff, patient traffic and specialties, going under expansion, the hospital director was an Avicenna HIS user and is eager to get the Avicenna HIS, some of the employees served in Avicenna HIS facilities before, have a Quality Assurance person. No dedicated IT staff, Few computers exist for administrative work use, No IT systems in place, limited computer network.	Dr. Husam Taneeb, the Hospital Director, Mobile +970-598-818903
2	Nablus	MOH Hospital	Wattani Hospital	62	215	100 years old Hospital, Oncology and Internal medicine hospital, Fragmented buildings, some are Under renovation, will be ready in two months, No operations theater. No dedicated IT staff (IT staff from Rafidia Hospital can be used with some additional support from the PMOH IT). Few computers exist for administrative work use, No IT systems in place, limited computer network. Has QA person 20% of the staff with previous Avicenna HIS experience Hospital director buy in to the Avicenna HIS is very high. Control of drugs at This hospital will have significant impact on the drug saving (Oncology drugs are very expensive).	Dr. Abdallah Alkhateeb, Hospital Director, Phone #: 970 – 59-9490038; Allan Souf, Hospital Administrative and financial Director Phone #: 970 -59-8816607;

3	Tubas	MOH Hospital	Tubas Hospital	38	120	<p>The Turkish government built the hospital, Opening was in May 2014, not enough staff yet. Ward equipment is also minimal, but enough to start. Administrative capacity is fully functional.</p> <p>Has QA person</p> <p>60,000 unique visits since it has opened</p> <p>60% of the staff with Avicenna HIS experience</p> <p>Equipped with computer network, computers and printers, ready to go with Avicenna HIS with minimal support.</p> <p>Implementation of the system needs local technical support.</p>	<p>Dr. Ayed A. Salim, Hospital Director</p> <p>Phone #: + 970 599 838-41</p> <p>Mohammad Khair, the administrative and financial Director</p> <p>Mobile #: +970 592-962165</p>
4	Yatta	MOH Hospital	Abu Alhasan Alqasem Hospital	58	140	<p>10 years old Hospital, not enough staff yet. Wards are not fully equipped, but enough to start.</p> <p>Has QA person</p> <p>25% of the staff with previous Avicenna HIS experience</p> <p>In development stage, some dept are on hold,</p> <p>Implementation cost should be minimal.</p> <p>No local warehouse (supplies, drugs are all in the pathways).</p> <p>Implementation of the system needs local technical support, (IT staff from Alia Hospital can be used with some additional support from the PMOH IT.</p> <p>Few computers exist for administrative work use, no IT systems in place, no computer network.</p>	<p>Dr. Ziad Abu Zahra, Hospital Director, Phone #: 970 – 59-5926413;</p> <p>Mohammad Abu Sabha, Hospital Administrative and financial Director</p> <p>Phone #: 970 598816602;</p>

Appendix E: Jiras/Issues log – example

Key	Summary	Resolution	Created
Avicenna HISRAF-71	Obstetrics and Gynecology Dept notes	UNRESOLVED	05/27/2012 2:09
Avicenna HISPMC-98	delete patient info حذف معلومات عن مريض	UNRESOLVED	05/02/2013 14:21
Avicenna HISPMC-416	stop service on حجب الخدمة عن مرضى الطوارئ emergency patients	UNRESOLVED	09/08/2013 13:30
PHCQAL-99	Local medical committee report تقرير اللجنة الطبية المحلية	UNRESOLVED	09/24/2013 22:17
Avicenna HISRAMPHC-92	Reports on the Medical تقارير المؤسسة الطبية (establishment (Driving License tests	UNRESOLVED	10/27/2013 11:13
Avicenna HISRAMPHC-102	ramallah_reporter_2	UNRESOLVED	10/31/2013 9:23
Avicenna HISRAMPHC-127	Mental Health الصحة النفسية	UNRESOLVED	11/14/2013 11:47
Avicenna HISRAF-1566	Add Departure time with the Departure Date to the order	UNRESOLVED	11/28/2013 8:51
Avicenna HISNPHC-375	Reports Page BAR024	UNRESOLVED	12/08/2013 3:43
Avicenna HISPMC-723	New lab devices	UNRESOLVED	01/31/2014 0:05
Avicenna HISRAF-1831	Form "Discharge Note Post Natal"	UNRESOLVED	02/06/2014 0:50
Avicenna HISRAMPHC-208	Chronic diseases الأمراض المزمنة	UNRESOLVED	02/11/2014 9:55
QAL-486	tissue test transferred فحص الأنسجة المحول الى م.رفيديا to Rafidia	UNRESOLVED	02/13/2014 13:11
Avicenna HISRAF-2003	report for outpatient clinics	UNRESOLVED	02/26/2014 13:22
BTL-11	Assign more maintenance technician	UNRESOLVED	03/04/2014 4:08
BTL-13	medical device receipt form تحديث نموذج استلام جهاز طبي	UNRESOLVED	03/04/2014 12:36
Avicenna HISRAF-2049	problem with patient medical record	UNRESOLVED	03/04/2014 13:47
BTL-39	Connect Cobas b 121 to Avicenna HIS	UNRESOLVED	03/08/2014 2:22
BTL-44	Connect Sysmex with Avicenna HIS	UNRESOLVED	03/08/2014 2:46
Avicenna HISRAF-2087	New born form فورم تبليغ عن مولود حي	UNRESOLVED	03/09/2014 23:55
Avicenna HISRAF-2088	Form فورم تبليغ عن مولود حي	UNRESOLVED	03/09/2014 23:58
BTL-174	Body Surface Area	UNRESOLVED	04/03/2014 12:28
PHCQAL-321	Form on a Medical Committee Pt. Added with a wrong name.	UNRESOLVED	04/07/2014 9:01
BTL-211	Issues with the registration قسم التسجيل	UNRESOLVED	04/11/2014 21:36

Appendix F: Facility implementation Costs (Flagship) – example



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	Tulkaram Government Hospital		
HIS	Unit Cost	Qty.	Subtotal
HIS Implementation	\$2,841.00	127	\$360,807.00
HP Products	Unit Cost	Qty.	Subtotal
HP DL380G8 Server	\$6,502.00	1	\$6,502.00
HP Universal Rack 10642 G2 Rack	\$5,652.00	1	\$5,652.00
HP TFT7600 Rack Mount Kybd 17in Intl Monitor	\$0.00	1	\$0.00
HP 0x2x8 KVM Svr Cnsl G2 SW	\$0.00	1	\$0.00
Cisco Products	Unit Cost	Qty.	Subtotal
Catalyst 3750X 24 Port Data IP Services Switch	\$8,168.00	2	\$16,336.00
Catalyst 3750X 24 Port Data IP Services Switch/three Year Warranty	\$469.00	6	\$2,814.00
Catalyst 2960S 24 GigE, 4xSFP LAN Base Switch	\$2,305.00	11	\$25,355.00
Catalyst 2960S 24 GigE, 4xSFP LAN Base Switch/three Year Warranty	\$188.00	33	\$6,204.00
Cisco 1921 Router	\$1,696.00	0	\$0.00
Cisco 1921 Router/3 Year Warranty	\$85.00	0	\$0.00
Cisco 2911 Router	\$3,520.00	1	\$3,520.00
Cisco 2911 Router/3 Year Warranty	\$528.00	3	\$1,584.00
SFP	\$350.00	36	\$12,600.00
Office Equipment	Unit Cost	Qty.	Subtotal
HP Compaq 6300 Pro Microtower PC + Three Tear Warranty	\$870.00	85	\$73,950.00
HP Standard Keyboard + 3 Year Warranty	\$0.00	85	\$0.00
HP Standard Mouse + 3 Year Warranty	\$0.00	85	\$0.00
HP LCD 20 inch Monitor + 3 Year Warranty	\$0.00	85	\$0.00
HP LaserJet Pro P1606 Printer + 1 Year Warranty	\$209.00	18	\$3,762.00
HP LaserJet Pro P1606 Printer /additional 2 Year Warranty	\$16.00	36	\$576.00
HP LaserJet M602x + 1 Year Warranty	\$1,422.00	3	\$4,266.00
HP LaserJet M602x/2 Year additional Warranty	\$153.00	6	\$918.00
HP ProBookn 6570B + 3 year warranty, 1 year battery	\$944.00	12	\$11,328.00
Zebra ZT220 Industrial Printers + 3 Year Warranty	\$940.00	3	\$2,820.00
Symbol LS2208-SR20001R-KR (Barcode Reader)	\$148.00	10	\$1,480.00
WRT54GL-EU Linksys Wireless Access point Router w/4 port switch – One Year Warranty	\$98.00	15	\$1,470.00
Server Room	\$24,500.00	1	\$24,500.00
APC Products	Unit Cost	Qty.	Subtotal
APC Smart-UPS On-Line 10 kVA + 2 Year Warranty (include Batteries)	\$8,017.00	1	\$8,017.00
1 KVA UPS	\$158.00	15	\$2,370.00



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HIS License	Unit Cost	Qty.	Subtotal
Avicenna 2.1, 600 user license	\$0.00	0	0
Avicenna HIS License @ 60% Dis	\$0.00	0	\$0.00
Avicenna HIS License @ 70% Dis	\$0.00	0	\$0.00
Avicenna HIS License @ 80% Dis	\$0.00	0	\$0.00
250 hours of Enhancement and Modifications	\$120.00	0	\$0.00
Kaspersky End Point Security 3 Years Included	\$27.00	100	\$2,700.00
Networking and Infrastructure Work at Sites	Unit Cost	Qty.	Subtotal
Fiber Links between FL Switches and Distribution Switches	\$990.00	20	\$19,800.00
Cabling (ethernet)	\$100.00	150	\$15,000.00
Medical Equipment	Unit Cost	Qty.	Subtotal
Medical Trolleys	\$5,544.00	6	33,264.00
Other Software Licenses	Unit Cost	Qty.	Subtotal
WinSvrStd 2012 OLP NL Gov 2Proc	\$955.00	3	2,865.00
Total			\$650,460.00

Appendix G: Detailed Summary Status of Avicenna HIS in Existing Health Facilities and Gaps

Resources including infrastructure:

Facility infrastructure (computers, networks) previously installed are in good condition at present time however an equipment refresh plan needs to be developed as some equipment is over four years old. This is a point of care implemented system leading to a near paperless implementation for a hospital. Many of the hospitals have desktop/ PCs implemented across departments at points of care. This often is over 50 computers per facility.

Electrical power outages occur in most of the hospitals, ranging in frequency from several times a day for several minutes to longer periods of time. Uninterruptable power supply is not available in most of the departments, the continuous expansion with new buildings keeps the door open for expanding the Avicenna HIS network and more resources will be needed.

System Utilization:

The system is in use in all hospital departments assessed starting at the patient's entry point for registration and in the clinical wards and outpatients clinics though patient discharge and accounting/billing. Supporting services departments including the Pharmacy, Lab, Radiology and pathology are also using the system. The administrative departments are also on the system including the maintenance (Bio medical engineering and general maintenance), the hospitals warehouse, diet and morgue.

In the primary health care clinics the system seems to be less utilized especially in the specialized clinics and other health departments like the mental health clinic, the mother and child care and environmental health departments.

Data Use:

Avicenna HIS data is used for administrative purposes more than the clinical. Most all those interviewed acknowledged the clinical information in the system is not of good quality. However, success stories abound regarding using the Avicenna HIS summary and patient data largely for administrative planning purposes. Several have developed ways to export the data out into Access and generate reports to look at department specific administrative and costing information.

Along with data quality improvement, data utilization needs top management engagement with enforcement to utilize the Avicenna HIS data in decision-making. Bed management, control of stock (drugs and other supplies), electronic archiving of patient information instead of paper files, and the unique medical record are the most significant benefits of Avicenna HIS.

Data migration of existing patient data, typically performed with the Avicenna HIS system is installed, was not performed at any facility assessed.

Data Quality:

Stakeholders routinely indicated data quality within the Avicenna HIS to be inadequate in general, with diagnosis and text particularly problematic. Somewhat recently, the D.G. of Hospitals has instituted a quality assurance team with a QA leader in Nablus and staff at various hospitals. System validation and range checks, along with trainings and M&E are needed.

Several hospitals have instituted their own initiatives, such as Alia hospital in Hebron, on both administrative and clinical data. Those initiatives should be shared and perhaps adopted by the Quality Assurance unit at the Hospitals General Directorate.

The WHO operates the Palestine Institute of Public Health which has a mandate to make health information actionable. Findings from their Avicenna HIS review concluded:

- Review of data accuracy study re: death notice reports (DNRs)
 - Avicenna HIS data accuracy (e.g. demographics, diagnoses) lower than paper-based medical records
 - Death report accuracy lower for Avicenna HIS users than for non-Avicenna HIS (paper-based) clinicians
- PHI mentioned considering deployment of a new human resources software solution (IRIS) to try to improve accuracy of DNRs
- Recommended alternatively focusing on improving overall Avicenna HIS discharge diagnosis accuracy

Maintenance and Support for Facility Level and Central:

A high frustration level was found at facility and central levels when Avicenna HIS support was discussed. Many stated they feel support was dropped with the end of the Flagship project. The current PMOH facility and data center maintenance contract with Dimensions is set to expire September 30, 2015. No recent maintenance contracts have been signed between the PMOH and the vendors. The Avicenna software is still under warranty which will expire by end of September 2015. A list of all software and hardware with their warranty expiry date will be provided by Dimensions. DataSel for some time has been providing minimal support according to the PMOH. The responsiveness to issues logged to the JERA system maintained by Dimensions is considered unacceptable by the PMOH and facility staff. The list of open issues is long. When discussed with DataSel, they indicated they did not have access to the JERA system and had not seen the list before.

Reporting:

All facilities reported having significant issues with the reports and lack of ability to change existing reports and produce ad hoc reports. Although the system has numerous standard reports and pivot tables for reporting, those reports are not up to the Palestine health information center satisfaction and needs. It is not easy for non-programmers to produce reports.

For reporting requests, users submit issue tickets online, called a JERIs. Sometimes a simple field level addition to a report is requested but not often acted upon by the vendors. Extracting reports from the medical forms attached to the patient's medical file is not doable.

Interoperability:

Avicenna HIS is a closed, proprietary system with lab and medical devices integration hardcoded in the system. The screens can't be customized or modified to accommodate the functionality of different specialties in the hospital. Data exchange with other systems is also a challenge in the system. Although DataSel indicates they support HL7 messaging, CDA and IHE profiles there was no evidence of this in the PMOH Avicenna HIS. During conference calls with DataSel, they acknowledged these data exchange standards do not exist in the current version but could be implemented in the next phase.

A meeting was held with the Palestinian National Public Health Institute to discuss a new reproductive health (RH) system based on DHIS2 tracker. The RH software initiative is NORAD funded and based on custom-developed DHIS2 Tracker web application. The target is to deploy the new MCH solution to 400 primary care sites. Concerns by the WHO staff were expressed as follows:

- MCH solution must be connected to "longitudinal" EHR (Avicenna HIS)
- Requirement, long term, to support more than just MCH at primary care sites

Data Center and Disaster Recovery:

The Avicenna HIS main data center is located in the ground level of Palestine Medical Complex located in Ramallah. The PMC facility () is fairly new having been inaugurated in 2010 as an autonomous secondary and tertiary care public hospital, providing advanced medical procedures.

Data Centers are typically assessed on the availability, integrity, confidentiality they provide and in accordance with established service level agreements (SLAs) which should be in place and indicate vendor requirements and standards that apply and are necessary for the Data Center to operate effectively. Several shortcomings found of the Data Center, all reported previously by the PMOH. Data Center uptime was observed as 99.39% for the past year. This equates to 3,206 minutes or 53 hours of down time a year. There have been concerns raised at facility level and PMOH regarding down time.

Uptime, indicated at 99.37%, is below the generally accepted industry accepted standard of 99.7%.

- The Data Center has UPS housed within and is reliant on the hospital for its primary source of power. The hospital has a backup generator.
- Dimensions monitors the Data Center continuously. Previously, a risk assessment was performed by an outside vendor and several of the weakness identified had been addressed). No data loss has been recorded in the history of the DC.
- Virus protection is updated weekly. Previously there has not been any attacks (such as denial of service) but viruses have occurred and been dealt with.
- Access is controlled at 2 entry points within the building. Card access is needed to enter the general area and work room. Servers are in an additionally secure area for servers

with only 3 staff having access to the server room, Cameras and alarm system is present, UPS is available. A raised floor and Air conditioning (8 sets) are present.

The Data Center houses the hospitals data servers (HP blade system) and (7 application servers) for the Avicenna HIS implemented PMOH hospitals. The Data Center also houses the PMOH servers for other purposes (e.g. Telemedicine server, HR system).

The Data center capacity had been upgraded in 2014, with a High availability Blade server solution (Processor: 4 x (2.13GHz/8-core), 32-core total, Memory 128GB), the current capacity should be enough to accommodate the four new hospitals. The Data Center was built by CMC (HP and Cisco subcontractor to Dimensions); they have no current role in the DC except if called by Dimension. Stand-alone data centers are not typically available in Palestine.

USAID under the Flagship project funded the building of the Data Center. Dimensions runs the center, remote monitoring and available onsite when needed, after their contract ends Avicenna HIS September 30, the DC will be under the PMOH's responsibility, but it is unclear who will maintain the DC. Data Center handover to the PMOH IT staff is not yet planned however this option would be well suited for the PMOH IT team and also establish ministry ownership.

Disaster Recovery (DR) site: A DR is located in the third floor of Rafidia hospital in Nablus. It is synchronized with the main data center in Ramallah. The Data Center access is controlled at 2 entry points within the building. Card access is needed to enter the general area and work room. Servers are in an additionally secure area with only 2 staff having access to the server room, cameras and alarm system is present. UPS is available, and a raised floor air conditioning (4 sets) is present. The HR server is near capacity and more storage is needed.

Warehouse:

The PMOH requested to have their Central warehouses under the Avicenna HIS, as their current system (Hulul) were running out of maintenance contract and they intended to have one centralized system to reduce the cost of maintaining two systems. Ultimitat team (namely Saeed Zeidan) who is working on the Avicenna HIS implementation was who developed the old warehouses system of Hulul. Dimensions (and Ultimitat) teams collected all the use cases and business processes of the three warehouses, and sent to DataSel a list of customizations needed on the Avicenna warehouses module to accommodate the PMOH central warehouses functionality. Dimensions and DataSel were late for about a year in implementing the warehouses module because they were working on the customizations requested. The training and implementation started late while the Flagship project was closing and was not completed. Most of the customizations had been made on Avicenna warehouses system to accommodate the workflow of the PMOH central warehouses work. The system is not being used by the Central warehouses, because of the inability to migrate the legacy data to the new system as the warehouses general director stated.

Avicenna HIS Vendors (DataSel, Dimensions, Ultimitat, CMC, Paltel and Menaltech, see Appendix J - Stakeholders):

The business relation between Dimensions and DataSel appear not be very healthy, Dimensions developed their own HIS system and made some lab equipment integration independently from DataSel contributing to an unhealthy relationship between the two businesses.

Information exchange (including RH DHIS 2 tracker system):

No system supports the information exchange with the DHIS2. For the time being, the Institute of Public Health is working on customizing the DHIS2 to be patient based aiming to utilize it at the Primary health care clinics. They started contacting DataSel for a data exchange proposal.

PMOH Readiness and Ownership:

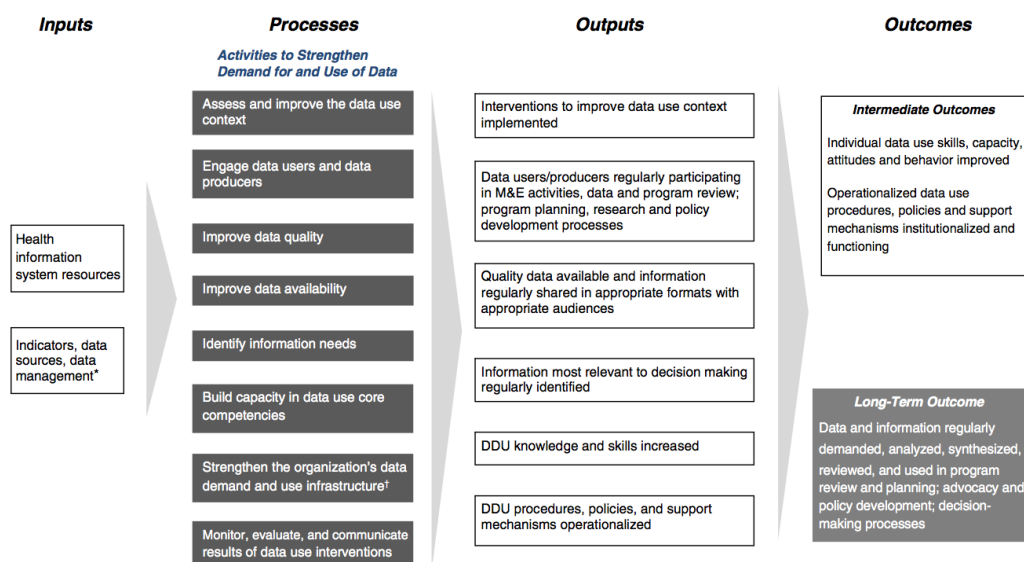
- **PMOH IT Avicenna HIS team readiness:** The PMOH IT team includes about thirty employees, many on location at the PMOH hospitals they support in the Palestinian territories, the team needs better management and follow up. A clear organizational structure that delineates responsibility and authority is very much needed. The Avicenna HIS teams (IT) Organizational structure (see Appendix I) is still pending and requires the Administrative General Director to approve. Specialized capacity building (e.g. Oracle, Systems Unix, Windows, Cisco) and Avicenna administration is required. Some champions had been identified among the team and were provided with limited administrator privileges. Once they get qualified, they can be an excellent resource for the Avicenna HIS facilities and reduce the level of effort required from DataSel or Dimensions.
- **PMOH Users ownership (facility level):** The users' ownership to the system appears to be very high. They all like the system and have no intention to go back for any reason. Many of them said we can't work without the Avicenna HIS. Resistance to change resistance initially encountered during the implementation of the system by Flagship is no longer a concern.
- **PMOH management sponsorship and facility level champions:** No top management sponsorship is in place, the Minister and related general directors are not up to date on the importance of the system and the value it can provide to PMOH., They don't appreciate the Avicenna HIS as much as the users in the facilities, because they don't use the system in their routine work. The department of finance needs to pay more attention to the Avicenna HIS needs. Although a separate budget line item was booked for the Avicenna HIS in the PMOH budget, the Avicenna HIS team couldn't use access those funds. The Hospitals General Directorate team needs to follow up with the facilities on the system and data use as well as data quality.

Appendix H: Data Demand and Use – the USAID MEASURE approach

Significant human and financial resources have been invested worldwide in the collection of data on populations, facilities and communities. Unfortunately, Avicenna HIS information is often not used by key stakeholders to effectively inform policy and programmatic decision making. The failure to consider all the empirical evidence before making decisions hinders a development system's ability to respond to priority needs throughout its many levels. In response to this issue, MEASURE Evaluation has developed an intervention and logic model that addresses the common barriers to data use. Specifically, the intervention broadens participation in and builds links between data collection and decision-making processes; identifies information needs; improves data quality; builds capacity to analyze, synthesize, and interpret data; and develops policies to support data use. To best apply the intervention in any given context, it is recommended that a rapid needs assessment be conducted to understand the current data use context and adapt the intervention to the specific country context.

The rapid needs assessment employs a mixed methods approach to capture data on: individual perspectives and opinions about the data use environment, individual experiences using data, perceived self-efficacy vs. actual ability to conduct specific data use tasks and the current data use environment in sub-national settings. In-depth interviews, administered skills assessments, in-person observations and site visits will be the primary data collection approaches employed. The proposed methods allow the collection of data on opinions, experiences, settings and capacity within a specific context. The needs assessment results will be validated in a workshop setting with key stakeholders. Solutions for barriers to data use identified by the assessment will be discussed and prioritized. A draft work plan for future data use will be developed. Illustrative topics for future data use activities include:

- Tools and approaches for creating and sustaining an enabling data use environment
- Tools and guidance for improving data use
- Data analyses for health programs (basic to advanced)
- Organizational and systems-level supports for data use
- Data visualization and communication
- Understanding 'the why' behind routine data
- Building leadership for data use
- Facilitating data use for gender aware programming

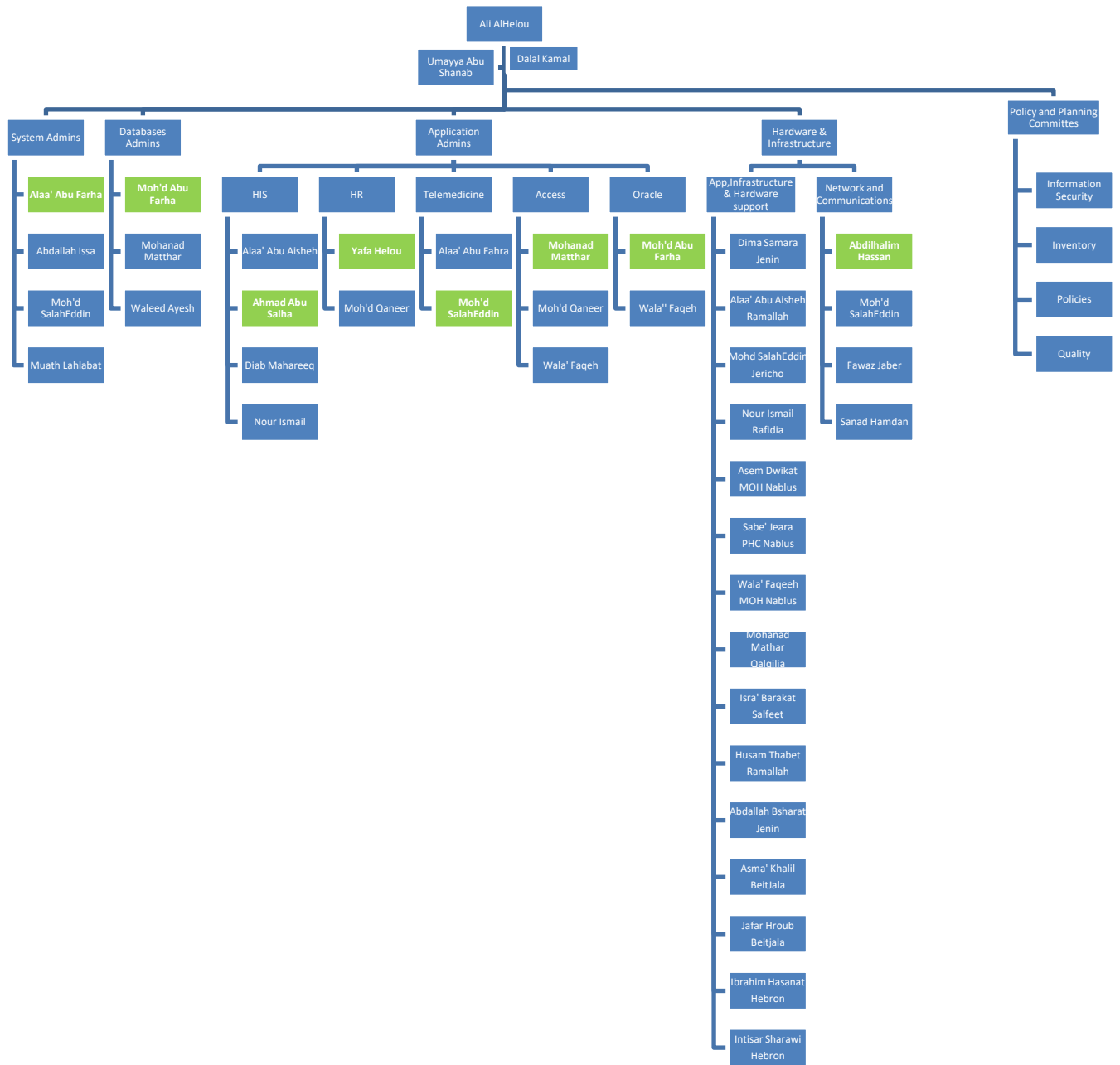


* Defined as processes by Health Metrics Network.

† The data demand and use approach broadly defines an organization as a division of the ministry of health at the national, state, or district-levels; a specific program within the ministry; or nongovernmental organization or program.

Fig 1. Logic model for strengthening the use of health data in decision making.

Appendix I: PMOH IT Proposed Organizational Structure



Appendix J: Stakeholders in Avicenna HIS

Stakeholder	Role	Responsibility
PMOH IT	Owner and user of Avicenna HIS	Provides overall leadership in direction setting of Avicenna HIS including new and existing facilities. Maintains PMOH IT Directorate comprised of 31 staff supporting Avicenna HIS at central and facility levels. Trained in Avicenna HIS by DataSel, the staff are highly technical and interact with Dimensions to report system issues they cannot fully address themselves. PMOH IT Director is located in Ramallah
USAID	Donor	Provided funding and project oversight for Flagship. Funder for PHCP project.
PMOH Directorate General	Director of PMOH Hospitals	Located in Nablus, provides leadership and administrative direction to all PMOH hospitals across Palestine. Has QA team, with ???
Minister of Health	Palestine Health leadership	Provides overall leadership in Palestinian public health and oversees PMOH IT
DataSel	Subcontractor to Dimensions	Designers of the Avicenna HIS Software http://www.DataSel.com.tr/index.php?lang=en Located in Ankara, Turkey.
Dimensions	Leads Avicenna HIS/Avicenna support / sub to Chemonics on Flagship	Locally contracted company in Ramallah that implements the system in cooperation with other specialized companies (e.g. Ultimitat for training and project management, CMC for hardware and Cisco network, infrastructure and networks). The organization is under a warranty period from the past contract with USAID through Flagship project until end of FY2015 for existing Avicenna HIS. Additionally it is currently implementing Avicenna HIS in Al Makassed hospital, an NGO facility, and Caritas Baby Hospital, and potentially at St Jones ophthalmic hospital using a locally developed system "Apex".
Ultimitat	Subcontractor to Dimensions	Subcontractor to Dimensions, This Ramallah based organization provides technical Avicenna HIS management and front line facility assessments, implementation and support of Avicenna HIS, and

		issue tracking. They work with PMOH IT staff at facility and national level and communicate directly with Dimensions and DataSel.
CMC	Subcontractor to Dimensions	Subcontractor to Dimensions provides Avicenna HIS hospital networking assessments and procurement of associated equipment and assists in equipment installation. They built the Data Center located at the PMC and the Disaster Recovery Center located in Nablus at Rafadia hospital.
Menaltech		A Jordanian company located in Amman, specializes in Human Resources Management Systems. Completely Web based.
PALTEL	Contracted by the Palestinian Government/ Finance	The Palestine Telecommunication Company provides connectivity (Fiber Optic) to the facilities under the Avicenna HIS through a governmental agreement between the company and the Palestinian government, which means that all connectivity fees are paid directly by the Palestinian ministry of finance (sustainable).

Appendix K: Recommendations

Phase I

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
1		Avicenna HIS Issue Management Address JIRAs				
	Immediate	<p>a. Address backlog of Avicenna HIS JIRA issues reported by PMOH.</p> <p>b. Establish helpdesk/PMOH IT for more effective issue management and communication</p>	<p>Avicenna HIS issues are captured via a Jira online system which Dimensions/Ultimatat maintains. There is one person as POC for all facilities and PMOH issues resulting in ineffective communication. Often DataSel must be contacted to assist. Many issues exist without resolution and are long standing. Duplicates exist. Issues are not well categorized and acted upon. Hospitals and the PMOH IT staff have 'given up hope' their issues will be resolved. With Dimensions supporting ending September 30, 2015 there appears little incentive.</p>	<ol style="list-style-type: none"> 1. Gain access to the JIRA system, review items, categorize (bug, new feature, etc.) and prioritize discussing with the PMOH and Dimensions/ULTIMIT AT and DataSel. 2. Identify issues that should be addressed before September 30 as part of current scope of Dimensions/ULTIMIT/ DataSel. Report Avicenna HIS to USAID. 3. Establish a term-limited/quarterly renewable DataSel – PMOH support contract to guarantee issue resolution. 4. Approve PMOH IT organizational structure 	<ol style="list-style-type: none"> 1. Improved and streamlined issue resolution 2. Timely resolution 3. Improved facility communication 	<p>Dimension s/Ultimatat , DataSel, PMOH, PHCP</p>

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
				5. Establish Avicenna HIS adequate administrative privileges for key PMOH IT staff with overseeing him by DataSel. 6. Establish helpdesk like mechanism at PMOH where they are primary POC can communicate with hospitals and work directly with DataSel if needed.		
2		Data Center and Disaster Recovery Site				
		Establish PMOH ownership of Data Center and Disaster Recover Site. Bring Data Center to industry standard operating specifications	The Data Center located in the PMC is maintained by Dimensions under contract until Sept 30, 2015. It maintains substandard uptime resulting from a lack dual lines from the internet service provider and temperature control alert procedures.			
	Immediate	a. Human Resources	The Data Center is currently under Dimensions, with the PMOH IT as a contact.	PMOH IT should take over, with a smooth transition and training on the Data center daily operations is needed 1. Transition Plan by Dimensions 2. Assessment of	1. Increase the LOE of the PMOH IT, less dependency on Dimensions and DataSel which result in maintenance cost saving	

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
				training needed. 3. Handover the Datacenter and DR site		
	Immediate	b. Software The PMOH should renew the Oracle license that expired May 2014, a maintenance contract with DataSel to support Avicenna HIS should be in place, maintain the source code escrow agreement	The Oracle license for Avicenna HIS expired May 2014. In previous Flagship project years, Dimensions/Ultimitat paid the annual Oracle licensing fee. The current implication is that the database is out of maintenance and not properly licensed. The PMOH must use local experts, compensating them for any required support.	Renew the annual Oracle license at a cost of \$50,138	2. Continued Avicenna HIS functionality with Oracle 3. Less reliance on outside support	PMOH
	Immediate	c. Hardware Increase the MENA HR server capacity d. Consider establishing dual power feeds	The HR Mena server needs assessment as it may be near capacity requiring additional storage for new facilities to come on. The temperature has risen in the DC at least 2 times in the past year to the alert level without receiving timely response. The Data Center relies on the PMC hospital and generator for power.	1. Assess servers so that PMOH Purchase of additional server storage	1. Increased capacity for HR server	PMOH, Dimensions/ULTIMIT
	Mid term	e. Connectivity Enhance Data Center connectivity to improve uptime	The Data Center has one line. When the line has an interrupt, Avicenna HIS is not available at the hospitals. The internet provider (IP) has scheduled maintenance at some interval. Previously, service down time has happened without communication from the IP in advance and caused Avicenna HIS to be inaccessible for 2 hours at a time.	1. Improve communication with IP 2. Establish dual, distinct lines so that down time is minimized if a line is cut or scheduled maintenance.	1. Lessen Data Center down time 2. Data Center uptime raised to industry standard	PMOH, Dimensions/Ultimitat

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
				3. Provide dual power feed so that uptime is within industry standard.		
	Immediate	f. Maintenance and Support Establish Data Center maintenance mechanism before September 30, 2015. Ideally, the PMOH IT should take over from Dimensions with some transition needed (maintenance contracts)	The Dimensions Data Center support contract will expire on September 30, 2015. Dimensions currently have 2 individuals supporting the Center and a service level agreement in place. Avicenna software will be out of maintenance by September 30 th , 2015, no bug fixes or support will be received from Dimensions/DataSel after this date. The Avicenna source code is held in escrow to safeguard against a situation where DataSel no longer continues as an active business.	1. Transition support of the PMC located Avicenna HIS Data Center and Nablus Disaster Recovery Site to the PMOH by having them transition from Dimensions/ULTIMIT AT 2- Maintenance contract to be renewed with DataSel as a transitional contract by quarter until such time as the transition to the PMOH is complete.	1. Increased PMOH ownership and sustainability 2. Cost savings	PMOH, Dimensions/Ultimitat, DataSel
3		Increase Avicenna HIS Functionality and Openness : APIs for medical devices, Analytics and Business Intelligence, Advanced Reporting and Admin privileges				
	Immediate	a. Engage with DataSel as soon as feasible to:	The Avicenna system is a closed, proprietary system. The PMOH does not have adequate functionality in the current	1. PHCP to facilitate detailed interactions with DataSel – PMOH	1. Increased Facility level Avicenna HIS	DataSel, USAID,

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
		<ul style="list-style-type: none"> - Finalize technical specifications of new enhancement requirements - Obtain a business proposal with costing information and timeline <p>Thereby obtaining enough information to propose solutions to the PMOH and USAID for FY 2016.</p>	<p>version nor system privileges for effective usage and maintenance. The PMOH relies on DataSel and Dimensions for many small of system requests. These requests often go unfulfilled. The current version is void of any enhancements made to the software at DataSel HQ. Specialty units require Avicenna HIS modification/ expansion / customization within Avicenna HIS some have been left undone.</p>	<p>to finalize Avicenna/Avicenna HIS enhancement technical specifications and obtain business proposal costing and timeline information, review with USAID and PMOH for approval.</p> <p>2. Trainings for PMOH IT champions and TOT in enhancements and Jasper reports</p> <p>3. Identify requirements and assess facilities that have specialty units not having Avicenna HIS implemented (goes for new units too)</p> <p>4. Planning for national level Data Warehouse</p>	<p>system privileges system use</p> <p>2. Increased reporting for facility and Central levels</p> <p>3. Increased analytics use by PMOH</p>	PMOH, PHCP
	Short to med term	b. Enhancements implemented and rolled out	The Avicenna HIS software version has not changed in 4 years Usability for PMOH IT champions is limited with support needed for most requests by DataSel.	<p>1. End user testing and piloting</p> <p>2. Establish system standard for national use</p> <p>3. Training (developer and end user)</p>		

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
				<ul style="list-style-type: none"> 4. Rollout to all facilities under Avicenna HIS 5. System feedback loop instituted and PMOH feedback loop (3 month internals) 		
4		PMOH Capacity Building and Change Management				
	Short to long term	<p>a. Technical Assistance to the PMOH in Change Management</p> <p>b. Organizational Avicenna HIS Capacity Building – Policies and Staff with Avicenna HIS PM working hand in hand with PMOH IT Director</p> <p>c. Technical assistance in Digital Health Strategy</p>	<p>The PMOH is poised to have major organizational change take place that will provide for more complete ownership of Avicenna HIS and create a culture of data and result in higher data quality and system use.</p> <p>Challenges exist; there is the need to seconded staff to the PMOH and for consistent PHCP support in FY 2016.</p>	<ul style="list-style-type: none"> 1. Second PHCP Avicenna HIS project management staff to PMOH to work with PMOH IT Director in Avicenna HIS change management and policies. 2. Support formation of PMOH chaired Avicenna HIS/IT committee 3. Present Avicenna HIS vision to Minister of Health to obtain buy-in; obtain approvals needed for PMOH IT to gain greater authority to have budget and run Avicenna HIS day-to-day. (Immediate) 	<ul style="list-style-type: none"> 1. Greater PMOH capacity ownership of Avicenna HIS 2. Inclusion of Avicenna HIS in PMOH annual budget; Avicenna HIS licenses and services paid by PMOH 3. Long term sustainability of Avicenna HIS 	PMOH IT, PHCP, Minister of Health

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
5		Data Quality and Use				
	Immediate	a. Perform data quality audits alongside PMOH QA and IT champions	Avicenna HIS data quality is generally considered incomplete and fairly poor.	<ol style="list-style-type: none"> 1. Establish small DQA team and perform data quality assessments in handful of facilities, train PMOH in Avicenna HIS process 2. Provide training on Data quality (including ICD10cm training) 3. Provide TA to establish policy/rules and regulations for Quality assurance, Committees in the Hospital 4. Work with DG of Hospitals QA lead to establish Avicenna HIS data quality plan that includes indicator setting, assessment, training, M&E. 5. Establish indicators of facility level data quality (to include diagnosis data) 6. Establish national level indicators 7. Forms design review 	<ol style="list-style-type: none"> 1. Improved data quality 2. Improved/increased system use for clinical decision support and health information exchange 	PMOH IT, D.G of Hospitals, PHCP

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
				8. Develop QC tools, Utilize MEASURE DQA and Data Use tools (see appendix H)		
	Short to long term	b. Build a culture of data use within the PMOH	Data use at facility and national level varies. Most all facilities utilize the Avicenna HIS well for administrative purposes but not for clinical. This is a missed opportunity.	1. Hold data use trainings 2. Form a community of practice/champions 3. Increase communications of stories and system information, utilize website/knowledge management 4. Establish requirements for custom reports/analytics/dashboards and POCs – accessible by all facilities. 5. Establish monitoring feedback loop	1. With data use trainings, improved reporting, system validation and verification capabilities utilized, facilities and central level should trust the data for more complete use including clinical decision-making.	PMOH IT and Avicenna HIS staff, PHCP, other TBD

Phase 2

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
6		New Facility Implementations				
	Mid to long term	Restructure Avicenna HIS Implementation Activities to	Facility Implementations are expensive, sequentially performed one at a time by	Institute Avicenna HIS implementation	Increased local PMOH Ownership	PMOH IT team, PHCP, CMC

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
		<p>enable PMOH ownership, cost savings, and timely scale up</p> <p>Implement Avicenna HIS in Tulkarem as soon as feasible given the population and region they serve (200K+), existing departments' needs, buy-in and eagerness by Medical Director, overall state of readiness and clinic staff committed to quality.</p> <p>This facility would immediately and significantly benefit by Avicenna HIS installation. Toubas is the second option as they already have networking, PCs and Printers installed.</p>	<p>subcontractor leaving facilities in wait mode for months and months. Dimension/ULTIMITAT requires coordination with DataSel. Relationship between DataSel and Dimensions has experienced some friction. Facilities feel they are not fully supported in Avicenna HIS, especially with Flagship project end in September 2014.</p>	<p>procedure changes that will save cost and time.</p> <p>Apply cost savings measures to drastically reduce facility implementation costs and subcontractor coordination. Enable parallel implementations; increase local/PMOH ownership, increase scale-up potential, decrease hardware refresh costs in future. Actions:</p> <p>Utilize PMOH and 1 PHCP salaried team member to implement Avicenna HIS in 4 new facilities</p> <p>Utilize N-computing / thin client architecture which is server client (less PCs)</p> <p>Procure hardware directly to eliminate markup via CMC in Tel Aviv</p>	<p>Decreased implementation costs (40% cost reduction)</p> <p>Reduced hardware refresh costs</p> <p>Reduce total timeline for multiple implementations. More timely implementation and performed in parallel</p> <p>Capacity for Avicenna HIS scale-up increased</p>	

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
				Reestablish hardware equipment manufacturers with focus on HP with extended warranties.		

Phase 3

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
7		New Facility Implementations				
	Long term	Implement Avicenna HIS in remaining 3 facilities Al Watani, Yatta, Toubas	These facilities have been waiting since 2014, are ready for Avicenna HIS. Toubas have networking, PCs and Printers already installed.		New facilities should increase number of patients since, access to patient information across hospital and for DG, cost savings Data included in Data Center	PMOH
8		Strengthen Avicenna HIS Infrastructure in Existing Facilities				
	Immediate	Strengthen Avicenna HIS Infrastructure in existing facilities and include new units Establish refresh plan and funding for aging equipment	Several Avicenna HIS facilities have new units that need Avicenna HIS installation including Alia Hospital Rafadia and other health facilities having equipment > 4 years old and need refresh plan soon.	Implement Avicenna HIS in new unit of Alia Hospital, Hebron as soon as feasible Discuss with PMOH IT, assist in establishing refresh plan	a. PMOH ownership and sustainability of Avicenna HIS	PMOH IT
9		Information Exchange and Interoperability between Avicenna HIS and other systems, SPD has the priority besides others such as MenaHR, WHO RH				
		a. WHO / Palestine Institute of Public Health RH	WHO will soon pilot a RH DHIS 2 tracker system to be scaled up in 400 primary healthcare clinics. The system needs to exchange health information with the Avicenna HIS.	1. Plan, develop, implement a health information exchange mechanism between the Avicenna HIS and DHIS	1. Effective data exchange of between the two systems resulting in less entry errors, less burden for	WHO/ Palestine Institute of Public Health,

#	Proposed Timeframe	Recommendation	Finding and Current Status	Proposed Actions	Outcomes and Benefits	Parties Involved
			No policies are in place to allow integration with other systems.	2 tracker system and/or other systems.	health workers in entering data, less of duplication information And Pave the road for national Avicenna HIS system	PMOH, PHCP
		b. Link with insurance, vital, and civil registries		1. Link with insurance, vital records and registration per PMOH		PMOH, Palestine government
10		Assess Surveillance Capacity for Timely Reporting of Diseases				
	Long term		Not yet assessed	1. Working alongside the PMOH and WHO/Palestine Public Health Institute to identify data sources, assess the overall electronic surveillance capabilities across systems for passive and active surveillance of disease reporting. Syndromic and case based reporting out of Avicenna HIS	1. Discuss findings PMOH, WHO and USAID the findings. 2. Provide TA in establishing a basic framework for real time reporting of diseases	PMOH, WHO, PHCP, others TBD